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Technology Evaluation Report SITE Program
Demonstration Test, HAZCON Solidification
Douglassville, Pennsylvania. Volume 2

Enviresponse, Inc., Livingston, NJ

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16. ABSTRACT: The major objectives of the HAZCON Solidification SITE Program Demonstration Test were to develop reliable performance and cost information. The demonstration occurred at a 50-acre site of a former oil reprocessing plant at Douglassville, PA containing a wide range of organic and heavy metal contaminants. The HAZCON process mixes the hazardous waste material with cement, a proprietary additive called Chloranan and water. The Chloranan is claimed to neutralize the inhibiting effect that organics normally have on the hydration of cement.

The technical criteria used to evaluate the effectiveness of the HAZCON process were contaminant mobility, based on leaching and permeability tests; and potential integrity of solidified soils, based on measurements of physical and microstructural properties.

Extensive sampling and analyses were performed showing 1) the concentration of the organics were the same in the leachates of the untreated and treated soils, 2) heavy metals reductions were achieved, and 3) structural properties of the solidified cores were found to indicate good long-term stability.

Cost per ton of contaminated soil at the Demonstration Test conditions was determined approximately $200. Given projected system improvements and adjustments of critical variables such as chemical additives, on-line factor, and equipment capacity, this cost was estimated to range as low as $90.

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SITE PROGRAM DEMONSTRATION TEST
HAZCON SOLIDIFICATION
DOUGLASSVILLE, PENNSYLVANIA

Volume II

by

Stephen Sawyer
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FOREWORD

The Superfund Innovative Technology Evaluation (SITE) program was authorized in the 1986 Superfund amendments. The program is a joint effort between EPA's Office of Research and Development and Office of Solid Waste and Emergency Response. The purpose of the program is to assist the development of hazardous waste treatment technologies necessary to implement new cleanup standards which require greater reliance on permanent remedies. This is accomplished through technology demonstrations which are designed to provide engineering and cost data on selected technologies.

This project consists of an analysis of Hazcon's proprietary solidification process and represents the second field demonstration in the SITE program. The technology demonstration took place at a former oil reprocessing plant which comprises the Douglassville Superfund site. The demonstration effort was directed at obtaining information on the performance and cost of the process for use in assessments at other sites. Documentation will consist of two reports. This Technology Evaluation Report describes the field activities and laboratory results. An Applications Analysis will follow and provide an interpretation of the data and conclusions on the results and potential applicability of the technology.

Additional copies of this report may be obtained at no charge from EPA's Center for Environmental Research Information, 26 West Martin Luther King Drive, Cincinnati, Ohio, 45268, using the EPA document number found on the report's front cover. Once this supply is exhausted, copies can be purchased from the National Technical Information Service, Ravensworth Bldg., Springfield, VA, 22161, (702) 487-4600. Reference copies will be available at EPA libraries in their Hazardous Waste Collection. You can also call the SITE Clearinghouse hotline at 1-800-424-9346 or 382-3000 in Washington, D.C. to inquire about the availability of other reports.

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ABSTRACT

The major objectives of the HAZCON Solidification SITE Program Demonstration Test were to develop reliable performance and cost information. The demonstration occurred at a 50-acre site of a former oil reprocessing plant at Douglassville, PA containing a wide range of organic and heavy metal contaminants. The HAZCON process mixes the hazardous waste material with cement, a proprietary additive called Chloranan, and water. The Chloranan is claimed to neutralize the inhibiting effect that organics normally have on the hydration of cement.

The technical criteria used to evaluate the effectiveness of the HAZCON process were contaminant mobility, based on leaching and permeability tests; and potential integrity of solidified soils, based on measurements of physical and microstructural properties.

Extensive sampling and analyses were performed showing 1) the concentration of the organics were the same in the leachates of the untreated and treated soils, 2) heavy metals reductions were achieved, and 3) structural properties of the solidified cores were found to indicate good long-term stability.

Cost per ton of contaminated soil at the Demonstration Test conditions was determined at approximately $205.

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* Volume II contains four appendices:
Operating Log Data; Sampling and Analytical Report; a Consultant's Report: Characterization of HAZCON Samples by Scanning Electron Microscopy, Optical Microscopy, and X-ray Diffraction; and Data Reduction Calculations

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* Volume I contains summary of results, process design, test site description, field activities, summary of the sampling and analytical program, analytical results, performance evaluation, and a discussion of costs.

ACKNOWLEDGMENTS

This document was prepared under the Superfund Innovative Technology Evaluation (SITE) Program by Enviresponse, Inc. for the U.S. Environmental Protection Agency under Contract No. 68-03-3255.

Enviresponse, Inc. would like to thank Mr. Paul de Percin of the EPA, the overall Douglassville Superfund Site Project Manager, Mr. Victor Janosik of EPA Region III, and other contributors from the EPA's Office of Research and Development, Office of Solid Waste and Emergency Response, and Region III Office.

In addition, we extend our appreciation to Mr. Timothy Smith from HAZCON Engineering, Inc.; and contributors from Radian Corporation, and Scientific Waste Strategies, Inc.

APPENDIX A

OPERATING LOG DATA

" Calibration Work Sheet "

Project No.: SITE   Project Location: Douglassville PA
Date: 10/13/87   Time: 5:00 pm   Batch No.: 2, Drum Storage

Accomplish the following procedure prior to each process run.

I Enter Prescribed Mix Ratios (note waste always equals 1)
  1. Pozzolan to Waste: 1:1
  2. Chloranan to Waste: .1 : 1

II Enter Pozzolan Bag Weight: 94
  * Cement 94 lbs/bag
  * flyash 70 lbs/bag
  * kilndust 50 lbs/bag

III Collect waste material from the charged waste auger for a 10 second time interval then calculate the following:

A. 10 second tare weight: 50 lbs
B. Multiply "A" by 6: 300 lbs (lbs waste per minute)
C. Multiply "B" by Mix Ratio #1: 300 lbs
D. Divide "C" by Pozzolan bag weight: 3.19
  (bags per minute)
E. Multiply "B" by Mix Ratio #2: 30 lbs
F. Divide "E" by 9 (lbs/gal): 3.33
  (gallons per minute)

IV Set controls on blending unit as follows:

1. Pozzolan accuvane setting to "D"
2. Chloranan flow control to "F"

V Verify and fine tune settings "1" and "2"

* Take weight of each over a 10 second interval.

Pozzolan: 51 x 6 = 306
Chloranan: 5 x 6 = 30

* Fine tune adjustments and repeat until actual weights are equal to calculated weights "C" and "E" to within +/- five percent, on two consecutive runs.

VI Calibration accomplished by:

* Material Monitoring Work Sheet *

To be used in conjunction with applicable Calibration Work Sheet(s) to determine process rates and material usage.

Project No.: SITE   Project Location: Douglassville PA

Date: 10/13/87   Time: 5:15 pm   Batch No.(s): 1 Drum Storage

Bag Counter Rate: 33
(i.e. 35=1 bag)

Pozzolan Totalizer Readings:

* start up: 164752 / "0"   time: 5:20
* check 1 :   time:
* check 2 :   time:
* other:

* end reading: 166458 / "1706"   stop time: 6:37

Calculations:

$33\overline{)1706}$ 51.7 × 94 = 4860 lbs

Chloranan Usage:

* start up: 210 gallons   time: 5:20
* check 1 :   time:
* check 2 :   time:
* other:

* end reading: 160   stop time: 6:37

Calculations:

50 gal × 10 lbs/gal = 500 lbs ± 100 lbs gen, why?
436 lbs actual

Water Usage:

* start up: 172.8 time: 5:20
* check 1 : time:
* check 2 : time:
* other:

* end reading: 360 stop time: 6:37

Calculations:

187.2 gal
= 1560 lbs

Total Pozzolan Used: 4860 lbs Total Waste Processed: 4860 lbs

Total Chloranan Used: 486 lbs Process Rate: 65 lbs/min.

Total Water Used: 1560 lbs.

Accomplished By: Tom Smith.

CMS-100 AND CMS-150

"ACCU-VANE" CALIBRATION FORM

1. CLEAN POCKETS OF "ACCU-VANE."
2. CHECK AIR SYSTEM - THE AIR SYSTEM MUST BE FUNCTIONING PROPERLY FOR ACCURATE METERING.

RUN 5 TRIALS TO 50 "COUNT" ON EACH TRIAL.

SILO S/N MFU-1

DATE 10/12/87

OWNER HAZCON Inc.

LOCATION Douglassville PA

CEMENT TYPE Type I Portland

MANUFACTURER Allentown Cement C

TRIAL	1	2	3	4	5	TOTALS
COUNTS	15	15	15	15	15	75
GROSS WT.	57 lbs	59 lbs	62 lbs	57 lbs	59 lbs	294 lbs
TARE WT.	16 lbs	16 lbs	16 lbs	16 lbs	16 lbs	80 lbs
NET WT.	41 lbs	43 lbs	46 lbs	41 lbs	43 lbs	214 lbs
TIME	10 sec	10 sec	10 sec	10 sec	9 sec	49 sec

TO DETERMINE METER COUNTS PER BAG (94 LBS.)

TOTAL POUNDS (214 lbs) / TOTAL COUNT (75) = 2.85 LBS./COUNT

94 LBS./CEMENT = (94) / LBS./METER CT. (2.85) = 33 COUNTS PER BAG OF CEMENT

FOR DISCHARGE TIME PER BAG OF CEMENT

NET WEIGHT (214) / SECONDS (49) = 4.37 LBS. PER SECOND

4.37 LBS. PER SECOND X 60 SEC. = 262.2 LBS. PER MINUTE

262.2 LBS. PER MINUTE DIVIDED BY 94 = 2.8 BAGS PER MINUTE

NOW THE "ACCU-VANE" IS CALIBRATED. ANY AMOUNT OF CEMENT CAN BE DISCHARGED BY MULTIPLYING THE NUMBER OF BAGS TO BE DISCHARGED BY THE COUNT ESTABLISHED ABOVE.

" Calibration Work Sheet "

Project No.: STTE Project Location: Douglassville PA

Date: 10/14/87 Time: 11:30 am Batch No.: 2 North Lagoon

Accomplish the following procedure prior to each process run.

I Enter Prescribed Mix Ratios (note waste always equals 1)
  1. Pozzolan to Waste: 1:1
  2. Chloranan to Waste: .1:1

II Enter Pozzolan Bag Weight: 94
  - * Cement 94 lbs/bag
  - * flyash 70 lbs/bag
  - * kilndust 50 lbs/bag

III Collect waste material from the charged waste auger for a 10 second time interval then calculate the following:

A. 10 second tare weight: 35 lbs
B. Multiply "A" by 6: 210 lbs (lbs waste per minute)
C. Multiply "B" by Mix Ratio #1: 210 lbs
D. Divide "C" by Pozzolan bag weight: 2.2 (bags per minute)
E. Multiply "B" by Mix Ratio #2: 21
F. Divide "E" by 9 (lbs/gal): 2.3 (gallons per minute)

WASTE

15 sec G 71
T 18
N 52 = 20

10 sec G 53
210 = T 18
N 35 = 2

IV Set controls on blending unit as follows:

1. Pozzolan accuvane setting to "D"
2. Chloranan flow control to "F"

POZZOLAN
36 × 6 = 216
210 — 35 × 6 = 210
35 × 6 = 210

V Verify and fine tune settings "1" and "2"

* Take weight of each over a 10 second interval.

Pozzolan: 35 x 6 = 210
Chloranan: 3.5 x 6 = 21

* Fine tune adjustments and repeat until actual weights are equal to calculated weights "C" and "E" to within +/- five percent, on two consecutive runs.

VI Calibration accomplished by:

" Material Monitoring Work Sheet "

To be used in conjunction with applicable Calibration Work Sheet(s) to determine process rates and material usage.

Project No.: SITE Project Location: Douglassville PA

Date: 10/14/87 Time: 11:30 am Batch No.(s): 2 North Lagoon

Bag Counter Rate: 33
(i.e. 35=1 bag)

Pozzolan Totalizer Readings:

* start up:	166516 / 0	time:	11:39	0
* check 1 :	380	time:	11:46	1
* check 2 :	690	time:	11:51	2
* other:	1170		11:56	3
	1389		12:01	4
* end reading:	168104 / 1588	stop time:	12:05 pm	

Calculations:

$$\begin{array}{r} 48.1 \\ 33\overline{)1588} \end{array} \times 94 = 4521 \text{ lbs}$$

Chloranan Usage:

* start up:	170 gal	time:	11:39
* check 1 :	155 gal	time:	11:46
* check 2 :	150 gal	time:	11:51
* other:	145 gal		11:56
	135 gal		12:01
* end reading:	130 gal	stop time:	12:05 pm

Calculations:

360 lbs ± 100 lbs gauge

? 450 lbs actual

Water Usage:

* start up: 386 gal time: 11:39
* check 1 : 437 time: 11:46 1
* check 2 : 490 time: 11:51 2
* other: 522 11:56 3
560 12:01 4
* end reading: 583 gal stop time: 12:05 5

Calculations:

197
~~203~~ gal × 8.33 = ~~1690~~ 1640

Total Pozzolan Used: 4521 lbs Total Waste Processed: 4521 lbs

Total Chloranan Used: 450 lbs Process Rate: 173 lbs/min

Total Water Used: 1690 lbs [illegible]

Accomplished By: Tim Smith.

" Calibration Work Sheet "

Project No.: SITE Project Location: Douglassville PA

Date: 10/14/87 Time: 4 30 pm Batch No.: 3, Filter Cake

Accomplish the following procedure prior to each process run.

I Enter Prescribed Mix Ratios (note waste always equals 1)
   1. Pozzolan to Waste: 1:1
   2. Chloranan to Waste: .1:1

II Enter Pozzolan Bag Weight: 94
   * Cement 94 lbs/bag
   * flyash 70 lbs/bag
   * kilndust 50 lbs/bag

III Collect waste material from the charged waste auger for a 10 second time interval then calculate the following:

   A. 10 second tare weight: 39 lbs
   B. Multiply "A" by 6: 234 lbs (lbs waste per minute)
   C. Multiply "B" by Mix Ratio #1: 234 lbs
   D. Divide "C" by Pozzolan bag weight: 2.5
   (bags per minute)
   E. Multiply "B" by Mix Ratio #2: 23 lbs
   F. Divide "E" by 9 (lbs/gal): 2.6
   (gallons per minute)

Waste
15 sec. = 42 lbs.
→ 168 lbs min

IV Set controls on blending unit as follows:

   1. Pozzolan accuvane setting to "D"
   2. Chloranan flow control to "F"

234
15 sec = 58 lbs
→ 232 lbs min
15 sec = 59 lbs
→ 236 lbs min

V Verify and fine tune settings "1" and "2"

   * Take weight of each over a 10 second interval.

   Pozzolan: 40 x 6 = 240
   Chloranan: 4 x 6 = 24

   * Fine tune adjustments and repeat until actual weights are equal to calculated weights "C" and "E" to within +/- five percent, on two consecutive runs.

Pozzolan
10 sec = 35 lbs
→ 210 lbs min
240 — 10 sec = 40 lbs
→ 240 lbs min

VI Calibration accomplished by: Tim [illegible]

* Material Monitoring Work Sheet *

To be used in conjunction with applicable Calibration Work Sheet(s) to determine process rates and material usage.

Project No.: SITE Project Location: Douglassville PA

Date: 10/14/87 Time: 4:30 pm Batch No.(s): 3 Filter Cake

Bag Counter Rate: 33
(i.e. 35=1 bag)

Pozzolan Totalizer Readings:

* start up: 168151 = 0 time: 4:46
* check 1 : 395 time: 4:50
* check 2 : 720 time: 4:54
* other: 1000 4:58

* end reading: 169707/ 1556 stop time: 5:03

Calculations:

$$33\overline{)1556}^{\,47} \times 94 \text{ lbs} = 4418 \text{ lbs}$$

Chloranan Usage:

* start up: 130 gal time: 4:46
* check 1 : 120 gal time: 4:54
* check 2 : 110 gal time: 4:59
* other:

* end reading: 105 gal stop time: 5 03

Calculations:

225 lbs ± 100 lbs gauge why
325 lbs actual

Water Usage:

* start up: 618 gal time: 4:46
* check 1 : 680 gal time: 4:50
* check 2 : 790 gal time: 4:57
* other:

* end reading: 892 gal stop time: 5:04

Calculations:

264 gal = 2199 lbs

Total Pozzolan Used: 4418 lbs Total Waste Processed: 4418 lbs

Total Chloranan Used: 325 lbs Process Rate: 234 lbs min.

Total Water Used: 2200 lbs.

Accomplished By: Tim

" Calibration Work Sheet "

Project No.: SITE Project Location: Douglassville PA

Date: 10/5/87 Time: 11:00 am Batch No.: 4, Land Farm

Accomplish the following procedure prior to each process run.

I Enter Prescribed Mix Ratios (note waste always equals 1)
   1. Pozzolan to Waste: 1:1
   2. Chloranan to Waste: .1:1

II Enter Pozzolan Bag Weight: 94 lbs/bag
   * Cement 94 lbs/bag
   * flyash 70 lbs/bag
   * kilndust 50 lbs/bag

Waste
15 seconds
42 × 4
- 168
50 × 4
- 200
55 × 4
- 220
58 × 4
- 232
55 × 4
- 220
224

III Collect waste material from the charged waste auger for a 10 second time interval then calculate the following:

A. 10 second tare weight: 37.3
B. Multiply "A" by 6: 224 (lbs waste per minute)
C. Multiply "B" by Mix Ratio #1: 224
D. Divide "C" by Pozzolan bag weight: 2.38 (bags per minute)
E. Multiply "B" by Mix Ratio #2: 22.4
F. Divide "E" by 9 (lbs/gal): 2.5 (gallons per minute)

Cement 10 second
29 × 6
- 174
38 × 6
- 228
38 × 6
- 228
228

IV Set controls on blending unit as follows:

1. Pozzolan accuvane setting to "D"
2. Chloranan flow control to "F"

V Verify and fine tune settings "1" and "2"

Chloranan 20
7 × 3 = 21
7 × 3 = 21
2.

* Take weight of each over a 10 second interval.

Pozzolan: 38 x 6 = 228
Chloranan: 3.5 x 6 = 21

* Fine tune adjustments and repeat until actual weights are equal to calculated weights "C" and "E" to within +/- five percent, on two consecutive runs.

VI Calibration accomplished by: Tom Smith

" Material Monitoring Work Sheet "

To be used in conjunction with applicable Calibration Work Sheet(s) to determine process rates and material usage.

Project No.: SITE Project Location: Douglassville PA

Date: 10/15/97 Time: 11:00 am Batch No.(s): 4 Land Farm

Bag Counter Rate: 33
(i.e. 35=1 bag)

Pozzolan Totalizer Readings:

* start up:	weighed 1'0"	time:	11:00
* check 1 :	565	time:	11:04
* check 2 :	962	time:	11:10
* other:	1100		11:22
	1344		11:25
* end reading:	2345	stop time:	11:46

Calculations:

$$\begin{array}{r}71\\33\overline{)2348}\end{array} \times 94\text{ lbs/bag} = 6688$$

Chloranan Usage:

* start up:	105 gal	time:	11:00
* check 1 :	95	time:	11:06
* check 2 :	70	time:	11:22
* other:			
* end reading:	40	stop time:	11:46

Calculations:

$$\overset{65}{\cancel{75}}\text{ gal} \times 9\text{ lbs/gal} = \overset{585}{\cancel{675}}\text{ lbs} \div 100\text{ lbs gauge}$$

668 lbs actual

Water Usage:

* start up: 902 gal time: 11:00
* check 1 : 967 gal time: 11:08
* check 2 : 1118 time: 11:22
* other:

* end reading: 1150 stop time: 1145

Calculations:

248 gal = 2066 lbs
+250 lbs drum
2316 lbs

Total Pozzolan Used: 6688 lbs Total Waste Processed: 6688 lbs

Total Chloranan Used: 668 lbs Process Rate: 145 lbs/min?

Total Water Used: 2316 lbs

Accomplished By:

" Calibration Work Sheet "

Project No.: SITE Project Location: Douglassville PA

Date: 10/15/87 Time: 4:00 pm Batch No.: 5 Plant Area

Accomplish the following procedure prior to each process run.

I Enter Prescribed Mix Ratios (note waste always equals 1)
  1. Pozzolan to Waste: 1:1
  2. Chloranan to Waste: .1:1

II Enter Pozzolan Bag Weight: 94 lbs/bag
  * Cement 94 lbs/bag
  * flyash 70 lbs/bag
  * kilndust 50 lbs/bag

Waste 15 sec

54×4
- 216
52×4
- 208
56×4
- 224

2
1
6

III Collect waste material from the charged waste auger for a 10 second time interval then calculate the following:

A. 10 second tare weight: 54
B. Multiply "A" by 6: 216 (lbs waste per minute)
C. Multiply "B" by Mix Ratio #1: 216
D. Divide "C" by Pozzolan bag weight: 2.3 (bags per minute)
E. Multiply "B" by Mix Ratio #2: 21.6
F. Divide "E" by 9 (lbs/gal): 2.4 (gallons per minute)

CEMENT, 10 sec

39×6
- 234
37×6
- 222
34×6
- 204

2
2
0

IV Set controls on blending unit as follows:

1. Pozzolan accuvane setting to "D"
2. Chloranan flow control to "F"

V Verify and fine tune settings "1" and "2"

Chloranan, 20 sec

7×3 = 21
7×3 = 21

* Take weight of each over a 10 second interval.

  Pozzolan: 37 x 6 = 222
  Chloranan: 3.5 x 6 = 21

* Fine tune adjustments and repeat until actual weights are equal to calculated weights "C" and "E" to within +/- five percent, on two consecutive runs.

VI Calibration accomplished by: Tom Smith

* Material Monitoring Work Sheet *

To be used in conjunction with applicable Calibration Work Sheet(s) to determine process rates and material usage.

Project No.: SITE   Project Location: Douglassville PA

Date: 10/5/87   Time: 4:00 pm   Batch No.(s): 5, Plant Area

Bag Counter Rate: 33
(i.e. 35=1 bag)

Pozzolan Totalizer Readings:

* start up: 172204/ "0"   time: 4:18
* check 1 : 700   time: — down 4:22, up 6:08
* check 2 : 844   time: 6:12
* other: 1474   6:20
1577   6:23

* end reading: 1738   stop time: 6:27

Calculations:

$$\begin{array}{r}53\\33\overline{)1738}\end{array} \times 94 \text{ lbs/bag} = 4982 \text{ lbs}$$

Chloranan Usage:

* start up: 118 gal   time: 4:18
* check 1 : 100 gal   time: 6:08
* check 2 : 98 gal   time: 6:12
* other: 80   6:20

* end reading: 75   stop time: 6:27

Calculations:

43 gal × 9 lbs/gal = 387 lbs average ± 100 lbs
492 lbs actual

Water Usage:

* start up: 1200 gal time: 4:18
* check 1 : 1326 gal time: 6:12
* check 2 : 1374 time: 6:23
* other:

* end reading: 1390 stop time: 6:27

Calculations:

190 gal × 8.33 lbs/gal = 1582 lbs

Total Pozzolan Used: 4952 lbs Total Waste Processed: 4982 lbs

Total Chloranan Used: 492 lbs Process Rate: ~

Total Water Used: 1582 lbs 4150

Accomplished By: Tim Smith.

" Calibration Work Sheet "

Project No.: SITE Project Location: Douglassville PA

Date: 10/16/87 Time: 1:00 pm Batch No.: 6. South Lagoon

Accomplish the following procedure prior to each process run.

I Enter Prescribed Mix Ratios (note waste always equals 1)
   1. Pozzolan to Waste: 1:1
   2. Chloranan to Waste: .1:1

II Enter Pozzolan Bag Weight: 94 lbs/bag
   * Cement 94 lbs/bag
   * flyash 70 lbs/bag
   * kilndust 50 lbs/bag

Waste 15 sec.
42×4
-168
47×4
-188
178

III Collect waste material from the charged waste auger for a 10 second time interval then calculate the following:

A. 10 second tare weight: 29.6
B. Multiply "A" by 6: 178 (lbs waste per minute)
C. Multiply "B" by Mix Ratio #1: 178
D. Divide "C" by Pozzolan bag weight: 1.9
   (bags per minute)
E. Multiply "B" by Mix Ratio #2: 17.8
F. Divide "E" by 9 (lbs/gal): 2
   (gallons per minute)

Cement 10 sec
31×6
-186
30×6
-180
183

IV Set controls on blending unit as follows:

1. Pozzolan accuvane setting to "D"
2. Chloranan flow control to "F"

Chloranan 20 sec
6×3=18
6×3=18

V Verify and fine tune settings "1" and "2"

* Take weight of each over a 10 second interval.

Pozzolan: 30.5 x 6 = 183
Chloranan: .3 x 6 = 18

* Fine tune adjustments and repeat until actual weights are equal to calculated weights "C" and "E" to within +/- five percent, on two consecutive runs.

VI Calibration accomplished by: Timothy E. Smith

" Material Monitoring Work Sheet "

To be used in conjunction with applicable Calibration Work Sheet(s) to determine process rates and material usage.

Project No.: STTE Project Location: Douglassville, PA

Date: 10/16/87 Time: 1:00 pm Batch No.(s): 6 South Lagoon

Bag Counter Rate: 33
(i.e. 35=1 bag)

Pozzolan Totalizer Readings:

* start up: 174032 / "0" time: 1:11
* check 1 : 1330 time: 1:27
* check 2 : 3662 time: 2:28
* other: 4690 3:20

* end reading: 181042 / 7010 stop time: 4:45

Calculations:

$\overset{212}{33\overline{)7010}}$ × 94 lbs/bag = 19928 lbs

Chloranan Usage:

* start up: 200 gal time: 1:11
* check 1 : 175 gal 1 time: 1:27
* check 2 : 70 gal time: 2:28
* other: 200 gal 2:28
190 gal 2 3:20
* end reading: 75 gal stop time: 4:45

Calculations:

1 = 130 gal
2 = 125 gal

255 × 9 lbs/gal = 2295 lbs gauge ±50

1993 lbs actual

Water Usage:

* start up: 1420 time: 1:11
* check 1 : 1550 time: 1:27
* check 2 : 1910 time: 2:28
* other: 2045 3:20

* end reading: 2600 stop time: 4:45

Calculations:

1180 gal × 8.33 lbs/gal = 9829 lbs
830
10659 lb

Total Pozzolan Used: 14928 lbs Total Waste Processed: 19928 lbs

Total Chloranan Used: 1993 lbs Process Rate: 5694 lbs/hr.

Total Water Used: 9829 lbs

Accomplished By: Tim Smith.

APPENDIX B

SAMPLING AND ANALYSIS AT THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT

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RADIAN
CORPORATION

DCN No. 88-272-008-02

SAMPLING AND ANALYSIS
AT THE HAZCON DOUGLASSVILLE SITE
DEMONSTRATION PROJECT

DRAFT FINAL REPORT

March 31, 1988

EERU Contract No. 68-03-3255

Work Assignment 2-R23

Enviresponse No. 3 80 00 020300

Prepared by:

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ANNOTATED LIST OF ABBREVIATIONS USED IN THIS REPORT

ANS 16.1:	Static leach test that involves immersing a cylinder of cohesive material sequentially in leaching fluid. The solids are allowed to remain in contact with the leaching fluid for periods of time ranging from one to 28 days. Data are reported for the cumulative time that the solids are in contact with the leaching fluid. The leaching fluids are analyzed for suspected contaminants. Ultrapure water was used as the leaching fluid for this analysis.
BNA:	Semivolatile organic compounds are prepared for analysis by extraction either into a base-neutral (BN) extract or an acidic (A) extract. Examples include phenol and naphthalene.
EP Extraction:	The extraction procedure (EP) specified by the United States Environmental Protection Agency to classify solid waste as hazardous (or not) according to the characteristic of "EP toxicity". Solids with reduced particle size are agitated for 24 hours. This test specifies only eight metals and six pesticides and herbicides to be measured in the extract.
EPA Method 680	A gas chromatographic/mass spectrometric (gc/ms) method to measure concentrations of PCB isomers that contain the same number of combined chlorine atoms.

EPA Method 8080	A gas chromatographic (gc) method to match patterns of complex mixtures of PCBs with known Arochlor patterns.
MCC-1P:	Static leach test that involves immersing a cylinder of cohesive material in leaching fluid. The solids are allowed to remain in contact with the same leaching fluid for periods of time ranging from three to 28 days. The leaching fluids are analyzed for suspected contaminants. Ultrapure water was used as the leaching fluid for this analysis.
PCBs:	Polychlorinated biphenyls are a group of related isomers of chlorinated organic compounds characterized by having 1 to 10 chlorine atoms substituted on the biphenyl group.
PP Metals:	Thirteen priority pollutant metals have been specified of particular environmental concern by the United States Environmental Protection Agency. The metals are antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, and zinc. Six of these metals were found in measurable concentrations in contaminated soils from the Douglassville site. To conserve resources, only the six metals that had been found at the site were analyzed for in many of the samples tested. The six metals found were: cadmium, chromium, copper, lead, nickel, and zinc.

TCLP Extraction:	The toxicity characteristic leaching procedure (TCLP) specified by the United States Environmental Protection Agency to classify solid waste as hazardous (or not) according to the characteristic of "TCLP toxicity". Solids with reduced particle size are agitated for 18 hours. This test specifies additional volatile and semivolatile organic compounds in addition to metals, pesticides, and herbicides that were tested in the EP extracts.
TOC:	Total organic carbon as measured by converting all carbon in the material to carbon dioxide.
UCS:	Unconfined compressive strength is measured by compressing an unconfined cohesive specimen until it fails under a given load.
VOC:	Volatile organic compounds are determined by purging volatiles from the sample tested. Examples include benzene and toluene.

SECTION 1

SAMPLING PROGRAM FOR HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROGRAM

A brief description of the sampling sites, sampling procedures, and sample custody procedures that were used during this program is presented in this section.

SITE DESCRIPTION

The HAZCON process was demonstrated at the site of a former oil reprocessing plant. The site is No. 102 on the National Priority List and is referred to as the Douglassville Disposal Site. It is on the south bank of the Schuylkill River in Berks County, Pennsylvania, and is approximately 11 miles southeast of Reading. The site covers approximately 50 acres. Soil contamination is primarily oil, grease, PCBs, and lead.

The six contaminated areas can be described as:

- Oil Drum Storage Area (DSA);
- Lagoon North (LAN);
- Filter sludge disposal area (FSA);
- Landfarm (LFA);
- Processing Facility (PFA); and
- Lagoon South (LAS).

HAZCON PROCESS DESCRIPTION

In the HAZCON process, contaminated soil is mixed with a cementitious material (Portland cement) and a patented additive, Chloranan, and the mixture

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is poured into molds. The mixture is reported to harden into a cohesive mass that immobilizes contaminants. The Chloranan is reported to make it possible to fix even wastes contaminated with high concentrations of organic compounds.

TEST PROGRAM

HAZCON operated a mobile processing unit on the Douglassville site for the demonstration. Contaminated soil was excavated, mixed with Portland cement and stabilizing ingredients, and poured into molds to solidify. Once treated soil solidified, it was placed in lined pits near the excavation sites.

Five of the feed soils were treated to produce four or five one-cubic-yard batches of treated soil. Soil from the Drum Storage Area was treated on October 13, 1987. Soils from Lagoon North and the Filter Sludge Area were processed October 14. Soils from the Landfarm Area and the Process Facility were treated on October 15. Soil from Lagoon South was processed in the nominal 30 cubic yard demonstration run on October 16. Toluene was injected into the treatment mix for soils from the Drum Storage Area, Landfarm Area, and processing area. The target toluene concentration was approximately 100 mg/kg, a typical concentration found at Superfund sites.

The treated soil from the five one-cubic-yard batches was poured into molds and allowed to set for 24 hours, then the solidified mix was returned to a lined pit in the area that the feed soil was obtained. Treated soil from the Lagoon South area was poured directly into three small molds and into a separate lined pit divided into three sections. The pit was near the area from which the contaminated soil was obtained.

SAMPLING LOCATIONS AND NUMBER OF SAMPLES

Radian collected samples of contaminated soil before treatment, treated unsolidified contaminated soil as it left the HAZCON processing unit, as a

TABLE 1. NUMBER OF TESTS FOR PHYSICAL PROPERTIES TO BE CARRIED OUT ON CONTAMINATED UNTREATED SOILS FROM THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT

Sample Type	Composite Designation	Composite Part Designation	Test Status	Undisturbed Soil		Composite Soils		
				Constant Head Permeability	Bulk Density	Grain Size	pH (Soil)	Moisture
Background Soil	1	1	Test	1	1	1	1	1
Background Soil 2	1	1	Reserve					
Drum Storage	1	1	Test	1	1	1	1	1
DSA	1	2	Test	1	1	1	1	1
	1	3	Reserve					
	2	1	Partial		1		1	1
Lagoon North	1	1	Test	1	1	1	1	1
LAN	1	2	Test	1	1	1	1	1
	1	3	Reserve					
	2	1	Test	1	1	1	1	1
	2	2	Partial		1		1	1
Filter Sludge	1	1	Test	1	1	1	1	1
FSA	1	2	Test	1	1	1	1	1
	1	3	Reserve					
	2	1	Partial		1		1	1
Landfarm	1	1	Test	1	1	1	1	1
LFA	1	2	Test	1	1	1	1	1
	1	3	Reserve					
	2	1	Partial		1		1	1
Processing	1	1	Test	1	1	1	1	1
Facility	1	2	Test	1	1	1	1	1
PFA	1	3	Reserve					
	2	1	Partial		1		1	1
Lagoon South	1	1	Test	1	1	1	1	1
LAS		2	Partial		1		1	1
	2	1	Test	1	1	1	1	1
	3	1	Reserve					
	4	1	Test	1	1	1	1	1
	5	1	Test	1	1	1	1	1

TABLE 2. NUMBER OF TESTS FOR CHEMICAL COMPONENTS IN CONTAMINATED UNTREATED SOILS TO BE CARRIED OUT FOR HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT

Sample Type	Composite Designation	Composite Part Designation	Test Status	PCBs in Soil by gc Method 8080	PCBs in Soil by gc/ms Method 680	VOC in Soil	BNA in Soil	13 PP Metals in Soil	Lead Only in Soil	Oil & Grease in Soil	TOC in Soil
Background Soil	1	1	Test	1	0	1	1	1		1	1
Background Soil 2	1	1	Reserve								
Drum Storage	1	1	Test	1	0	1	1	1		1	1
DSA	1	2	Test	1	0	1	1	1		1	1
	1	3	Reserve								
	2	1	Partial						1	1	
Lagoon North	1	1	Test	1	0	1	1	1		1	1
LAN	1	2	Test	1	0	1	1	1		1	1
	1	3	Reserve								
	2	1	Test	1	0	1	1	1		1	1
	2	2	Partial						1	1	
Filter Sludge	1	1	Test	1	0	1	1	1		1	1
FSA	1	2	Test	1	0	1	1	1		1	1
	1	3	Reserve								
	2	1	Partial						1	1	
Landfarm	1	1	Test	1	0	1	1	1		1	1
LFA	1	2	Test	1	0	1	1	1		1	1
	1	3	Reserve								
	2	1	Partial						1	1	
Processing	1	1	Test	1	0	1	1	1		1	1
Facility	1	2	Test	1	0	1	1	1		1	1
PFA	1	3	Reserve								
	2	1	Partial						1	1	
Lagoon South	1	1	Test	1	0	1	1	1		1	1
LAS		2	Partial						1		
	2	1	Test	1	0	1	1	1		1	1
	3	1	Reserve								
	4	1	Test	1	0	1	1	1		1	1
	5	1	Test	1	0	1	1	1		1	1

TABLE 3. NUMBER OF TESTS TO BE CARRIED OUT ON TCLP EXTRACTS OF CONTAMINATED UNTREATED SOILS FOR HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT

Sample Type	Composite Designation	Composite Part Designation	Test Status	Toluene Spike?	TCLP Extraction	Extra TCLP Extraction for O & G	PCBs in TCLP by gc	PCBs TCLP by gc/ms	VOC in TCLP	BNA in TCLP	6 PP Metals[a] in TCLP	Oil and Grease in TCLP
Background Soil	1	1	Test	No	1	1	1	1	1	1	1	1
Background Soil 2	1	1	Reserve									
Drum Storage	1	1	Test	Yes	1	1	1	1	1	1	1	1
DSA	1	2	Test	Yes	1	1	1	1	1	1	1	1
	1	3	Reserve									
	2	1	Partial									
Lagoon North	1	1	Test	No	1	1	1	1	1	1	1	1
LAN	1	2	Test	No	1	1	1	1	1	1	1	1
	1	3	Reserve									
	2	1	Test	No	1	1	1	1	1	1	1	1
	2	2	Partial									
Filter Sludge	1	1	Test	No	1	1	1	1	1	1	1	1
FSA	1	2	Test	No	1	1	1	1	1	1	1	1
	1	3	Reserve									
	2	1	Partial									
Landfarm	1	1	Test	Yes	1	1	1	1	1	1	1	1
LFA	1	2	Test	Yes	1	1	1	1	1	1	1	1
	1	3	Reserve									
	2	1	Partial									
Processing	1	1	Test	Yes	1	1	1	1	1	1	1	1
Facility	1	2	Test	Yes	1	1	1	1	1	1	1	1
PFA	1	3	Reserve									
	2	1	Partial									
Lagoon South	1	1	Test	No	1	1	1	1	1	1	1	1
LAS		2	Partial									
	2	1	Test	No	1	1	1	1	1	1	1	1
	3	1	Reserve									
	4	1	Test	No	1	1	1	1	1	1	1	1
	5	1	Test	No	1	1	1	1	1	1	1	1

[a] Cadmium, chromium, copper, lead, nickel, zinc.

TABLE 4. LIST OF TESTS TO BE CARRIED OUT ON TREATED SOILS COLLECTED AS SLURRIES FOR THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT

			Treated Soil After 7 Days							TCLP								
Sample Type	Mold Designation	Test Status	Falling Head Permeability	Bulk Density	Moisture	UCS 1	UCS 2	UCS 3	VOC in Solid	Toluene Spike ?	TCLP Extraction	Extra TCLP Extraction for O & G	PCBs in TCLP by gc	PCBs in TCLP by gc/ms	VOC in TCLP	BNA in TCLP	6 PP Metals[a] in TCLP	Oil and Grease in TCLP
Cement Only	1	Partial				1	1	1										
Background + Cement	1	Test	1	1	1	1	1	1										
Lagoon North + Cement	1	Test	1	1	1	1	1	1										
Filter Sludge + Cement	1	Test	1	1	1	1	1	1										
Drum Storage	M1	Test	1	1	1	1	1	1	1	yes	1	1	1	1	1	1	1	1
	M3	Test	1	1	1	1	1	1	1	yes	1	1	1	1	1	1	1	1
Lagoon North	M1	Test	1	1	1	1	1	1	1	no	1	1	1	1	1	1	1	1
	M4	Test	1	1	1	1	1	1	1	no	1	1	1	1	1	1	1	1
	M5	Test	1	1	1	1	1	1	1	no	1	1	1	1	1	1	1	1
Filter Sludge	M1	Test	1	1	1	1	1	1	1	no	1	1	1	1	1	1	1	1
	M3	Test	1	1	1	1	1	1	1	no	1	1	1	1	1	1	1	1
	M5	Test	1	1	1	1	1	1	1	no	1	1	1	1	1	1	1	1
Landfarm	M1	Test	1	1	1	1	1	1	1	yes	1	1	1	1	1	1	1	1
	M3	Test	1	1	1	1	1	1	1	yes	1	1	1	1	1	1	1	1
	M5	Test	1	1	1	1	1	1	1	yes	1	1	1	1	1	1	1	1
Processing Facility	M1	Test	1	1	1	1	1	1	1	yes	1	1	1	1	1	1	1	1
	M2	Test	1	1	1	1	1	1	1	yes	1	1	1	1	1	1	1	1
	M3	Test	1	1	1	1	1	1	1	yes	1	1	1	1	1	1	1	1
Lagoon South	SM2	Test	1	1	1	1	1	1	1	no	1	1	1	1	1	1	1	1
	LM1	Test	1	1	1	1	1	1	1	no	1	1	1	1	1	1	1	1
	LM2A	Test	1	1	1	1	1	1	1	no	1	1	1	1	1	1	1	1
	LM2B	Reserve																
	LM2C	Test	1	1	1	1	1	1	1	no	1	1	1	1	1	1	1	1

[a] Cadmium, chromium, copper, lead, nickel, zinc.

TABLE 5. NUMBER OF PHYSICAL TESTS AND WEATHERING TESTS TO BE CARRIED OUT ON TREATED SOILS COLLECTED AS FIELD CORES FOR THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT

Sample Type	Core Designation	Test Status	Permeability	Bulk Density	Moisture	Compressive Strength	Wet/Dry Weathering	Compressive Strength on Wet/Dry Weathering	Freeze/Thaw Weathering	Compressive Strength on Freeze/Thaw Weathering
Cement Only		Test				3				
Background Soil + Cement		Test	1	1	1	3				
Lagoon North + Cement (Lab)		Test	1	3	3	3				
Filter Sludge + Cement (Lab)		Test	1	3	3	3				
Drum Storage DSA	DSA 1	Test	1	3	3	3	1	2	1	2
	DSA 3	Test	1	3	3	3	1	2	1	2
	DSA 4	Test	1	3	3	3	1	2	1	2
Lagoon North LAN	LAN 1	Test	1	3	3	3	1	2	1	2
	LAN 4	Test	1	3	3	3	1	2	1	2
	LAN 5	Test	1	3	3	3	1	2	1	2
Filter Sludge FSA	FSA 1	Test	1	3	3	3	1	2	1	2
	FSA 3	Test	1	3	3	3	1	2	1	2
	FSA 5	Test	1	3	3	3	1	2	1	2
Landfarm LFA	LFA 1	Test	1	3	3	3	1	2	1	2
	LFA 3	Test	1	3	3	3	1	2	1	2
	LFA 5	Test	1	3	3	3	1	2	1	2
Processing Facility PFA	PFA 1	Test	1	3	3	3	1	2	1	2
	PFA 2	Test	1	3	3	3	1	2	1	2
	PFA 3	Test	1	3	3	3	1	2	1	2
Lagoon South LAS	LAS SM2	Test	1	3	3	3	1	2	1	2
	LAS LM1	Test	1	3	3	3	1	2	1	2
	LAS LM2A	Test	1	3	3	3	1	2	1	2
	LAS LM2B	Reserve								
	LAS LM2C	Test								

TABLE 6. NUMBER OF TESTS FOR CHEMICAL PROPERTIES TO BE CARRIED OUT ON TREATED SOILS COLLECTED AS FIELD CORES FOR THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT

Sample Type	Core Designation	Test Status	VOC in Treated Soil	BNAs in Treated Soil	6 PP Metals[a] in Treated Soil	Oil and Grease in Treated Soil
Drum Storage DSA	DSA 1	Test	1	1	1	1
	DSA 3	Test	1	1	1	1
	DSA 4	Test	1	1	1	1
Lagoon North LAN	LAN 1	Test	1	1	1	1
	LAN 4	Test	1	1	1	1
	LAN 5	Test	1	1	1	1
Filter Sludge FSA	FSA 1	Test	1	1	1	1
	FSA 3	Test	1	1	1	1
	FSA 5	Test	1	1	1	1
Landfarm LFA	LFA 1	Test	1	1	1	1
	LFA 3	Test	1	1	1	1
	LFA 5	Test	1	1	1	1
Processing Facility PFA	PFA 1	Test	1	1	1	1
	PFA 2	Test	1	1	1	1
	PFA 3	Test	1	1	1	1
Lagoon South LAS	LAS SM2	Test	1	1	1	1
	LAS LM1	Test	1	1	1	1
	LAS LM2A	Test	1	1	1	1
	LAS LM2B	Reserve				
	LAS LM2C	Test	1	1	1	1

[a] Cadmium, chromium, copper, lead, nickel, zinc.

TABLE 7. NUMBER OF TESTS TO BE CARRIED OUT EP AND TCLP EXTRACTS OF TREATED SOILS COLLECTED AS FIELD CORES FOR THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT

Sample Type	Core Designation	Test Status	EPA EP Extract	6 PP Metals[a] in EP	EPA TCLP Extract	PCBs by gc Method 8080	PCBs by gc/ms Method 680	VOC	BNA	6 PP Metals[a]	Oil and Grease
Drum Storage	DSA 1	Test			1	1		1	1	1	1
DSA	DSA 3	Test			1	1		1	1	1	1
	DSA 4	Test			1	1		1	1	1	1
Lagoon North	LAN 1	Test	1	1	1	1	1	1	1	1	1
LAN	LAN 4	Test	1	1	1	1	1	1	1	1	1
	LAN 5	Test	1	1	1	1	1	1	1	1	1
Filter Sludge	FSA 1	Test	1	1	1	1	1	1	1	1	1
FSA	FSA 3	Test	1	1	1	1	1	1	1	1	1
	FSA 5	Test	1	1	1	1	1	1	1	1	1
Landfarm	LFA 1	Test			1	1		1	1	1	1
LFA	LFA 3	Test			1	1		1	1	1	1
	LFA 5	Test			1	1		1	1	1	1
Processing	PFA 1	Test			1	1		1	1	1	1
Facility	PFA 2	Test			1	1	1	1	1	1	1
PFA	PFA 3	Test			1	1	1	1	1	1	1
Lagoon South	LAS SM2	Test			1	1	1	1	1	1	1
LAS	LAS LM1	Test			1	1	1	1	1	1	1
	LAS LM2A	Test			1	1	1	1	1	1	1
	LAS LM2B	Reserve									
	LAS LM2C	Test			1	1	1	1	1	1	1

[a] Cadmium, chromium, copper, lead, nickel, zinc.

TABLE 8. NUMBER OF TESTS TO BE CARRIED OUT ON ANS 16.1 EXTRACTS OF TREATED SOILS COLLECTED AS FIELD CORES FOR THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT

Sample Type	Core Designation	Test Status	ANS 16.1 Extraction	PCBs by gc Method 8080	PCBs by gc/ms Method 680	VOC	BNAs	6 PP Metals[a]	Oil and Grease
Static Leach Blanks		Test Test	1		1	1	1	1	1
Drum Storage DSA	DSA 1 DSA 3 DSA 4	Test Test Test	1						
Lagoon North LAN	LAN 1 LAN 4 LAN 5	Test Test Test	1	5	5	5	5	5	5
Filter Sludge FSA	FSA 1 FSA 3 FSA 5	Test Test Test	1	5	5	5	5	5	5
Landfarm LFA	LFA 1 LFA 3 LFA 5	Test Test Test	1						
Processing Facility PFA	PFA 1 PFA 2 PFA 3	Test Test Test	1	5	5	5	5	5	5
Lagoon South LAS	LAS SM2 LAS LM1 LAS LM2A LAS LM2B LAS LM2C	Test Test Test Reserve Test	1	5	5	5	5	5	5

[a] Cadmium, chromium, copper, lead, nickel, zinc.

TABLE 9. NUMBER OF TESTS TO BE CARRIED OUT ON MCC-1P EXTRACTS OF TREATED SOILS COLLECTED AS FIELD CORES FOR THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT

Sample Type	Core Designation	Test Status	MCC-1P Extract	PCBs by gc Method 8080	PCBs by gc/ms Method 680	VOC	BNAs	6 PP Metals[a]	Oil and Grease
Static Leach		Test	1	1	1	1	1	1	1
Blanks		Test	1						
Drum Storage	DSA 1	Test							
DSA	DSA 3	Test	1						
	DSA 4	Test							
Lagoon North	LAN 1	Test							
LAN	LAN 4	Test	1	4	4	4	4	4	4
	LAN 5	Test							
Filter Sludge	FSA 1	Test							
FSA	FSA 3	Test	1	4	4	4	4	4	4
	FSA 5	Test							
Landfarm	LFA 1	Test							
LFA	LFA 3	Test	1						
	LFA 5	Test							
Processing	PFA 1	Test							
PFA	PFA 2	Test	1	4	4	4	4	4	4
	PFA 3	Test							
Lagoon South	LAS SM2	Test							
LAS	LAS LM1	Test	1	4	4	4	4	4	4
	LAS LM2A	Test							
	LAS LM2B	Reserve							
	LAS LM2C	Test							

[a] Cadmium, chromium, copper, lead, nickel, zinc.

slurry and solidified contaminated soil after more than 28 days exposure to field conditions.

Shelby tubes were used to collect contaminated, untreated soil core samples for permeability and bulk density measurements. Sample collection sites for these soil cores were selected by applying a grid over the area designated for treatment by the HAZCON process. Points on the grid were randomly selected to obtain Shelby tube cores. Composite samples of contaminated soil were collected from excavated soil after screening or were taken from earth moving equipment as the contaminated soil was fed to the HAZCON mobile treatment unit.

Grab samples of treated contaminated soil were collected as the treated mix was discharged from the mobile treatment unit. Samples were collected three different times during each short treatment run and five samples were collected during the long treatment run. These treated soil samples were returned to Radian's laboratories and tested for unconfined compressive strength approximately nine days after treatment.

Samples of solidified treated soils that had been exposed to field conditions for more than 28 days were obtained as cores from the solidified masses that were placed in the lined pits.

Samples that were collected and the tests that were scheduled to be applied to them are listed in Tables 1 through 9. Not all samples that were collected were scheduled to be tested. Some were held in reserve in case samples were damaged during shipment, additional sample was required, or repeat measurements were needed. For contaminated untreated soils, two composites were prepared for each of the five-cubic-yard areas. Two sample sets were tested from the first composite for each of the treatment runs that produced five cubic yards, that is: Drum Storage Area, Lagoon North, Filter Sludge Area, Landfarm Area, and the Processing Facility. A third sample set (from composite 2) was tested for soils from Lagoon North, and selected tests

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were applied to samples from composite 2 for most of the runs. Five composite soils were collected from the Lagoon South area. Soils from this area were used for the long test run, nominally 30 cubic yards. Four of the five composites from Lagoon South were analyzed.

For treated soils collected as slurries, three samples were collected and tested for each of the five-cubic-yard runs, and five samples were collected and four were tested for the longer test run.

After more than 28 days in the field, one sample set was drilled from each of three different blocks selected from the five blocks of solidified contaminated soil for each of the five-cubic-yard test runs. Cores were drilled at five randomly selected areas of the large solidified mass from the long test run. Sample collection sites for the treated solidified soils were selected by the field crew. Three samples were tested for each of the five-cubic-yard runs, and four samples were tested for the longer test run.

SAMPLING PROCEDURES

The paragraphs that follow describe:

- General principles that applied to sample collection;
- Procedures that were employed to collect contaminated soil, treated soil collected as a slurry, and solidified treated soil collected as cores after more than 28 days in the field; and
- Sample collection monitoring.

Sample Collection

Samples were collected according to sampling methods described in SW-846. Quality control procedures included collection of replicate samples, sampling equipment preparation (pre-cleaning, etc.), and sample handling (pre-treatment, preservation, etc.). Quality control efforts associated with sampling contaminated soils and treated soils included:

- All sampling equipment was thoroughly cleaned before samples were collected from each source.
- All samples were preserved as required.
- All sample containers were cleaned in accordance with specific sampling method requirements. Glass containers except VOA vials were cleaned according to Protocol A (wash with laboratory grade detergent then rinse with dilute nitric acid, water methylene chloride, and oven dried). VOA vials were cleaned according to Protocol B (wash with laboratory grade detergent and rinse with water and oven dried). Containers cleaned by IChem Corporation were used. Quality control of the cleaning process consisted of using EPA Method 625 to check containers cleaned by Protocol A and EPA Method 624 to check containers cleaned by Protocol B. Cardboard molds and Shelby tubes required no special cleaning.
- Replicate samples were collected as described in Tables 1 through 9.
- Samples for volatile organic carbon compound analysis were transferred to containers with a minimum of agitation and disturbance.

Untreated Contaminated Soil Samples

Contaminated soil core samples were collected for bulk density and permeability measurements. The Radian sampling crew went to the area designated for a given test before excavation began and obtained the scheduled number of cores using 3-inch Shelby tubes. Three Shelby tube samples were collected from each of the following areas: Drum Storage, Lagoon North, Filter Sludge Landfarm, and the Processing Facility. Five Shelby tube samples were taken from the Lagoon South area. The depth of the cores collected depended on the estimated depth of contamination in the area being sampled and on the ability of the Shelby tube to penetrate the soil. Some areas were very rocky, and Shelby tubes could not penetrate to the scheduled depth. The cores were sealed by covering the ends of the Shelby tube with aluminum foil and sealing with tape. Plastic packing foam was added to the portions of the tubes that were not filled with soil to be sure that the cores maintained structural integrity during shipping.

Composite samples of contaminated soil for the remaining tests were collected from the pile of excavated screened soil at the drum storage area and from a pile of excavated but unscreened soil at the filter sludge area. The consistency of the contaminated material at the filter sludge area made screening impractical. Composites for the remaining areas were taken from the front end loader as the contaminated soil was transferred to the mobile processing unit. Scoops were used to obtain the composite soil samples. Twelve individual soil portions were taken from different parts of the composite pile or from the material in the front-end loader. The individual portions that were obtained each time the scoop or shovel was dipped into the soil were placed into a plastic container. Once all individual portions were collected, the contents of the container were dumped onto a plastic sheet and thoroughly mixed. The mixture was transferred to individual labeled sample containers.

Treated Slurry Samples

Treated slurry samples were collected at the discharge point of the HAZCON mobile processing unit. For five of the areas, five one-cubic-yard molds were scheduled to be filled with the treated soil slurry. Grab samples were scheduled to be taken while the first, third, and fifth one-cubic-yard molds were being filled. This pattern was followed for the Filter Sludge Area and the Landfarm. During treatment of soil from the Drum Storage Area only four molds were filled, and slurry was collected only from the first and third mold. During treatment of soil from Lagoon North, processing difficulties occurred, and slurry samples were taken while the first, fourth, and fifth molds were filled. During treatment of soil from the Processing Facility, slurry samples were taken while the first, second, and third molds were filled.

Five slurry samples were collected while soil from Lagoon South (the long test run) was being processed. The first was collected from the second small mold to be filled. The second was collected while the first large mold was being filled. The remaining samples were collected from the second large mold to be filled. The third large mold was not filled because the long treatment run was not completed.

Each grab sample was collected with a stainless steel dipper. The dipper was specially fabricated by adding a long handle to a six-quart stainless steel pan purchased from a restaurant supply house. The dipper had a capacity of approximately 1500 mL, and the handle was four feet long. Samples collected using the pan were dumped into a plastic dishpan and immediately packed into cylindrical cardboard molds and glass containers. Samples for strength and permeability tests were placed in the cardboard cylinders, and samples for other tests, including chemical analyses, were placed in wide mouth glass jars. Care was taken to use material that have not come into contact with the plastic container to fill the glass containers. The wide mouth glass jars were sealed with Teflon®-lined screw-on caps. The cardboard cylinders were sealed in individual plastic bags.

Solidified Soil Samples

After more than 28 days of curing in the field, samples of solidified soil were collected using a rotary-drill rig with core barrel. Cores were removed from the solidified blocks in a pattern designed to obtain solidified material that represented the entire block of material. The diameter of the

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cores obtained were 7.0 cm for unconfined compressive strength and permeability tests and 4.5 cm for weathering tests and static leach tests. Each core was removed from the core barrel and sealed in a glass jar or in impervious material to minimize moisture loss. Core samples were placed in cartons filled with foam shaped to fit the cores to minimize disturbance to the cores while they were shipped.

CALIBRATION PROCEDURES FOR SAMPLING EQUIPMENT

The Shelby tubes and scoops used to obtain solid samples did not require calibration. A top-loading balance was used to record sample weights. A positive displacement pump was used to add toluene to the treatment mix. Calibration of the balance and pump are discussed below.

Balance Calibration

Before the field sampling activities, the top loading balance was calibrated on site using standard weights (NBS Class P) over the expected range of use. Measured values agreed within ±0.01 g of the standard values for masses less than 1000 g, and ±0.1 g for masses greater than 1000 g.

Pump Calibration

The pump used to deliver toluene was calibrated immediately before delivery using toluene. The delivery rate was calculated using a graduated cylinder and a stopwatch for a period not less than 30 seconds. This procedure was repeated until duplicate measurements agreed within ±10%. The total amount of toluene delivered to each treatment run was determined by weighing the container of toluene at the beginning and at the end of the run.

SAMPLE CUSTODY

Sample custody is an organized scheme for documenting sample history and providing a record of the measurement process. The types of documentation associated with the sampling effort included:

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- Sample logbooks;
- Sample preparation records; and
- Chain-of-custody records.

Chain-of-custody procedures were followed to ensure a documented, traceable link between any given measurement result and the sample and the variable that it represented. These procedures were intended to provide a legally acceptable record of sample preparation, shipment, storage, and analysis. In addition to chain-of-custody forms, a set of master logbooks were used as a centralized mechanism to document project activities.

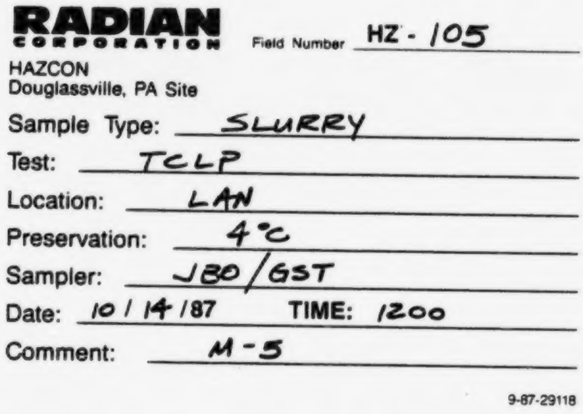
Logbooks

Field notebooks and a master sample log were used to record sampling activities and information. Notebook entries included general sampling information to reconstruct the site activities without reliance on memory. The beginning of each entry included the date, sampling site, start time, weather conditions, field personnel present, and level of personal protection. Other entries included unusual conditions that might impact the interpretation of the sampling data, or problems with the sampling equipment. All entries were in ink with no erasures. Incorrect entries were crossed out with a single strike and initialed.

A master sample log was maintained for all samples taken. A full description of the sample, its origin, and condition was included in the master log entry.

Sample Labeling System

Each sample was assigned a unique identification number. Additional information was provided on the sample container label. An example sample label is shown in Figure 1.



RADIAN CORPORATION Field Number HZ - 105

HAZCON
Douglassville, PA Site

Sample Type: SLURRY

Test: TCLP

Location: LAN

Preservation: 4°C

Sampler: JBO/GST

Date: 10/14/87 TIME: 1200

Comment: M-5

9-87-29118

Figure 1. Example label used for the HAZCON SITE Demonstration Project.

ADDITIONS TO SAMPLING TASK

Additional Samples Collected

At the request of Enviresponse, several samples not listed in the QAPP were collected. These samples included the feed water and cement feed. The feed water was collected without filtration, aliquots were preserved for:

1) TOC analysis with sulfuric acid;
2) Metals with nitric acid;
3) Anions and pH with no preservative.

Photographs

Photographs were made of samples of treated soils collected as field cores in November and of cores subjected to weathering tests. These photographs were not scheduled originally.

SAMPLING DEVIATIONS FROM THE QAPP

Deviations from the QAPP that occurred during the sampling phase of the project are listed briefly below.

Change in Area for 30-Cubic-Yard Test

The 30-cubic-yard test was carried out on material collected from Lagoon South (LAS) area rather than the Filter Sludge Area (FSA) as indicated in the QAPP. The change was made because excavation equipment could not be operated in the FSA.

Project Schedule

The project schedule as listed in Table 1-4 of the QAPP was extended.

Selection of Points to Obtain Core Samples

In Section 4, (p. 4 of 19) it was stated that a statistical grid would be applied to select sampling points for core samples collected from solidified masses in the field. During core sampling, field conditions were so rigorous that areas to collect core samples were selected based on scientific judgment. Since most of the solidified masses were relatively small, it is believed that this approach yielded representative samples.

Staff for Core Sample Collection

Two people were required to collect core samples rather than the one person originally scheduled.

Labels

A customized label was substituted for the label shown in Section 4 (19 of 19) of the QAPP.

Core Sample Collection Dates

Cores of treated samples were collected from November 17 through November 24. This represented time periods for sample collection ranging from 35 to 42 days after treatment rather than the nominal 28 days listed in the QAPP. Unconfined compressive strength measurements were made on November 30 and December 1, so curing times could range from 45 to 49 days. Field cores were collected to examine properties after exposure to field conditions after enough curing time that relatively little change would be expected. The additional time in the field and additional time from treatment to strength measurement is expected to make very little difference in the results obtained.

SECTION 2

ANALYSIS PROGRAM FOR HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT

ANALYSIS PROGRAM

The analysis program was carried out according to descriptions given in the QAPP, with some exceptions. The exceptions are listed in the following paragraphs.

Laboratory Performing Tests

In Table 1-3, Section 1 (p. 8 of 11) of the QAPP, a number of tests were listed to be carried out in Radian's Laboratories in Perimeter Park, North Carolina. To improve scheduling, some of the tests (metals and volatiles in solids and in TCLPs) were carried out in Radian's Laboratories in Sacramento, California. This change should make no difference in data quality.

Constant Head Permeability

Constant head permeability measurements were made on cores collected in Shelby tubes not on remolded samples as specified by ASTM D 2434. The direct measurement method produces a more accurate permeability measurement because the samples are relatively undisturbed and therefore more representative of the soil structure in the field (Klute and Dirksen, 1986; Stephens, *et al*. 1987). The ASTM method requires packing and remolding of the sample which alters its permeability.

For the laboratory measurements, each Shelby tube was fitted with a porous-stone filter and plexiglass cap at each end. Water manometers were attached to holes drilled into the tubes approximately one inch from the ends

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of each sample. Water flowed from a constant-head source, through the sample, and into a collection beaker. The permeability was calculated using Darcy's equation:

$$P = \frac{Q}{T} \times \frac{dl}{dh} \times \frac{1}{A}$$

where: P = Permeability (cm/sec.);
Q = Flow through column (cm^3);
T = Time (duration of Q) (sec.);
dl = Length between manometer points (cm);
dh = Head difference in manometers (cm); and
A = Cross-sectional area of tube = $\left(\frac{d}{2}\right)^2$ (cm^2)

Figure 2 illustrates the equipment used for the constant head permeability test.

Soil pH Measurements

Section 4 (page 11 of 19) states that soil pH measurements would be made in the field. Soil pH was measured in the laboratory in Austin, Texas, because the field schedule made it impossible to measure pH in the field. This change should make no difference in the results obtained.

Oil and Grease in TCLP Leachates

No method was listed in Table 5-1 of the QAPP for oil and grease in TCLP leachates or in ANS 16.1 or MCC-1P leachates. EPA Method 413.2 (oil and grease using infrared spectrometry) was used for these leachates because the infrared method is more sensitive than the gravimetric method that was applied to solids.

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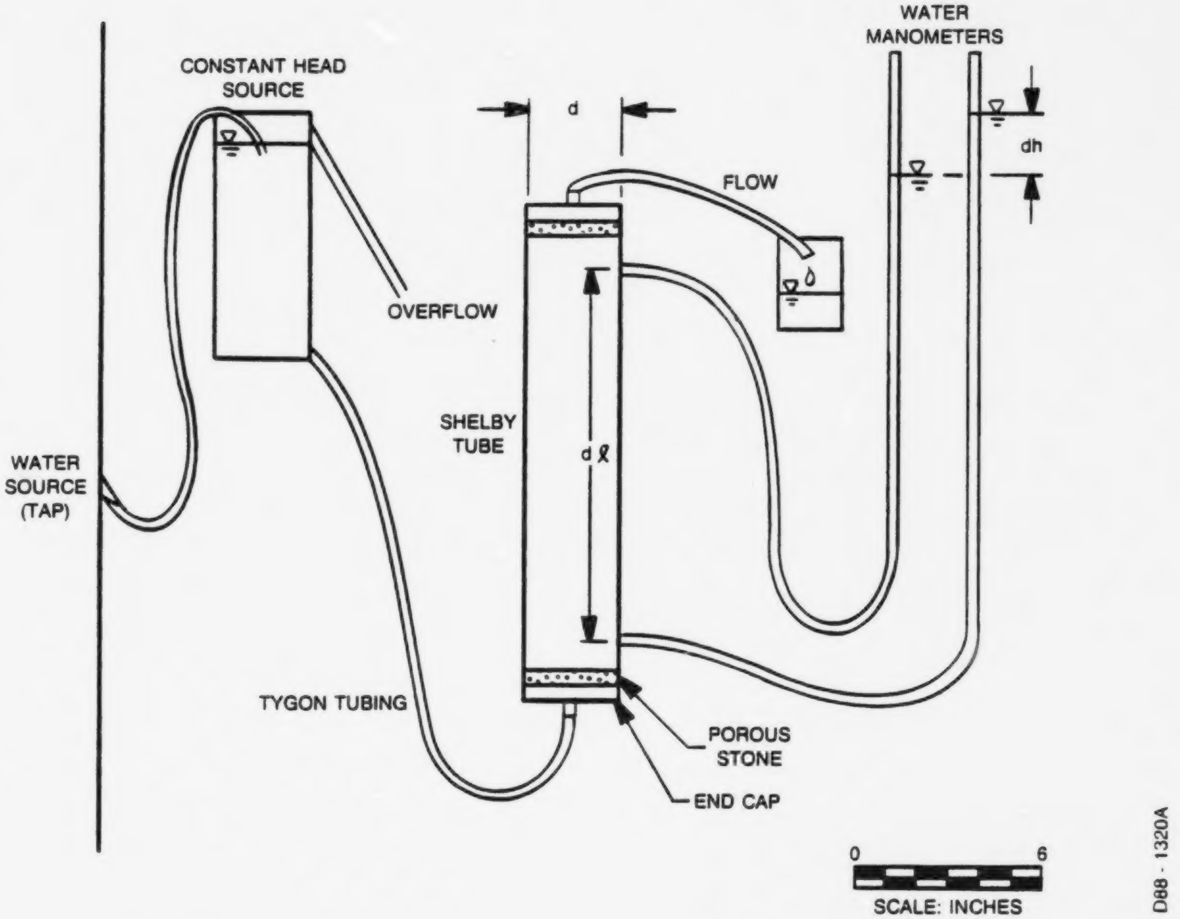
WATER MANOMETERS
CONSTANT HEAD SOURCE
d
dh
FLOW
OVERFLOW
SHELBY TUBE
d ℓ
WATER SOURCE (TAP)
TYGON TUBING
POROUS STONE
END CAP
0
6
SCALE: INCHES
D88 - 1320A

Figure 2. Equipment used to measure constant head permeabilities of soils collected in Shelby tubes.

TCLP Extractions on Untreated Soils

At the request of Enviresponse, TCLP extractions were performed on untreated soils. Analyses on the TCLP extracts included PCBs, VOC, BNA, 6 PP metals, and oil and grease.

Dates for Unconfined Compressive Strength Measurements on Treated Soils Collected as Slurries

Unconfined compressive strength was measured on treated soils collected as slurries on October 22, 23, and 26, 1987. These dates represented about nine days after collection rather than the seven days scheduled. This difference in schedule is not expected to make a significant difference in the results obtained.

Permeability Measurement Dates

Permeability measurements on the treated soils collected as slurries were delayed significantly past the scheduled dates because initial attempts to saturate samples were unsuccessful. After several unsuccessful attempts to saturate the samples, it was noted that the surface that had been in contact with the metal bottom of the molds used for collection had a glazed appearance. Permeability measurements were possible only after the glazed surface was removed by abrasion. This procedure was considered to be appropriate because the only surface that was glazed was the one in contact with the metal bottom of the cardboard cylinder. The other surfaces were not glazed, and no glazed appearance was observed on surfaces of treated soil molded in plywood containers in the field.

Calibration of GC/MS for TCLP Extracts

More frequent calibrations than indicated in Table 5-2 in the QAPP were required for the GC/MS when TCLP extracts were analyzed. The acetate present in the TCLP extracts contaminated columns so they could not be used. The columns had to be replaced at frequent intervals and each new column had to be calibrated.

Strength Measurements for Weathered Samples

At the request of Enviresponse, unconfined compressive strength measurements were added for samples that had been subjected to freeze/thaw and wet/dry weathering tests.

Duplicate ANS 16.1 and MCC-1P Extractions

Section 7 (p. 9 of 11) states that ANS 16.1 and MCC-1P static leach tests would be carried out in duplicate. This is an error in the QAPP.

CLP Reporting Forms for Inorganic Analysis Data

The forms for reporting inorganic data have been revised by EPA since the QAPP was written. Therefore, new forms were used to report the inorganic analyses rather than the forms specified in the QAPP.

CLP Reporting Forms for Organic Analysis Data

The CLP reporting forms specified in the QAPP do not coincide with the more extensive target lists specified by the analytical methods that were used. Instead, a CLP-type of reporting format, similar to the forms, was developed.

Toluene Spikes of Soil Samples

In Enviresponse's original request for proposal, it was specified that toluene would be added to selected mixtures during treatment. It was also specified that the soil samples that corresponded to these spiked slurries would be spiked to corresponding levels in the laboratory prior to analysis of volatile organics. Although there is no mention of this in the QAPP, it was done for the appropriate samples. Three untreated contaminated soil samples were spiked with known amounts of toluene before they were subjected to TCLP extraction. The soils that were spiked were the ones that had toluene injection during treatment. The concentration of toluene added was the concentration found in the treated samples collected as slurry.

Wide-Bore Capillary GC Method for PCB Analysis

Table 1-3 in the QAPP incorrectly identifies the use of a wide-bore GC column (0.5 mm i.d.) for high-resolution analysis of PCBs in Aroclors as a "modification" of SW-846 Method 8080. The QAPP implied that Radian would use this modified method rather than the actual SW-846 method. Radian used Method 8080 for most tests and used the wide-bore capillary GC method only to obtain greater resolution of peaks in selected patterns that could not be interpreted as Aroclors. These tests were run to confirm the need to perform Method 680 on extracts.

Sample Preparation

The QAPP specifies Methods 3510 and 3540 for sample preparation, but does not mention SW-846 Method 3520 (continuous extraction) or Method 3550 (sonication extraction), which are the preferred methods for the aqueous and solid samples, respectively, and were used when applicable. Some of the contaminated soil samples required further cleanup using Method 3611, Alumina Column Cleanup and Separation of Petroleum Wastes, for organic analyses, although this method was not specified in the QAPP.

VOA Sample Containers/VOA Duplicate Samples

The QAPP stated that samples for volatiles analysis would be collected in 500-mL glass jars sealed with Teflon-lined lids. However, the procedure for volatiles analysis calls for sample collection in VOA vials. It was not specified in the QAPP, but duplicate VOA samples should have been obtained in VOA vials. For the first batch of soils and slurries, the samples for volatile organics analysis were collected in single 500-mL jars. This meant that the jars had to be opened and portions of the sample removed and placed into VOA vials. For the slurries, which had "set" as solid concrete, this was a particularly difficult problem. The solid concrete had to be chiseled out of the jar and chunks of it placed into VOA vials. In the second sample collection, the cement cores were too large in diameter to be placed in VOA vials. So a single core sample was sent in a 500-mL jar. Again, the solid had to be ground up to create multiple VOA samples--one for screening, one for analysis, and one for back-up. The issue of how to effectively analyze cement samples for volatile organics was not addressed in the QAPP. Radian, therefore, used a methodology based on previous experience in VOA analyses for other types of solids. It appears that a procedure for preparing cement-like samples for volatiles analysis needs to be developed.

Number of Samples

The number of samples received for each type of analysis was not consistent with the QAPP. Table 10 is a brief summary of the number of samples specified in the QAPP versus the number actually received and analyzed at Radian.

Effect of Sample Quantities on Detection Limits

The QAPP specifies method detection limits, but does not specify the correct amount of sample per analysis to correspond to these detection limits. Each solid sample for TCLP was divided into portions for several extractions in order to produce 1 liter of leachate for each of the following analyses: BNA, VOA, PCB, and oil and grease. Metals analysis requires about 100 mL. However, in many cases, the amount of sample sent was not enough to do the required number of extractions, and reserve samples had to be used. The

TABLE 10. SUMMARY OF TESTS PERFORMED, INCLUDING TESTS ON QUALITY CONTROL SAMPLES FOR THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT

Test	Untreated Soils Tested	Treated Slurries Tested	Treated Cores Tested	Tests to Evaluate Need for 680 Tests	Total Number of Tests Performed	Proposal Tests Scheduled for Untreated Soils	Proposal Tests Scheduled for Treated Slurries	Proposal Tests Scheduled for Field Cores	Proposal Total Number of Tests Scheduled
Permeability	15	19	24		58	15	15	15	45
Bulk Density	21	31	71		123	15	15	15	45
Grain Size	16				16	15			15
Soil pH	25				25	15			15
Moisture	25	31	71		127	15	15	15	45
Compressive Strength		93	72		165		15	15	30
Wet/Dry Weathering			19		19			15	15
UCS on Wet/Dry Weathering			38		38				0
Freeze/Thaw Weathering			19		19			15	15
UCS on Freeze/Thaw Weathering			38		38				0
PCBs in Solids (8080)	17				17	16			16
PCBs in Solids (680)					0				0
VOC in Solids	16	19	20		55	16	16	16	48
BNAs in Solids	34		19		53	16		16	32
13 PP Metals in Solids	18				18	15			15
6 PP Metals in Solids*			19		19				0
Lead only in Solids	6				6				0
Oil & Grease in Solids	23		19		42	15		15	30
TOC in Solids	17				17	15			15
EP Extraction			6		6				0
6 PP Metals in EP Extract			6		6				0
EPA TCLP	17	19	20		56	16	16	15	47
Extra TCLP for Method 680			12		12				0
Extra TCLP for Oil & Grease	18	22	19		59				0
PCBs in TCLP (8080)	17	19	19		55	16	16	15	47
PCBs in TCLP (680)	4	7	12		23				0
VOC in TCLP	17	19	19		55	16	16	15	47
BNAs in TCLP	17	19	19		55	16	16	15	47
13 PP Metals in TCLP					0	15			15
6 PP Metals in TCLP	17	19	19		55		15	15	30
Oil & Grease in TCLP	18	22	19		59				0

(Continued)

TABLE 10. (Continued)

Test	Untreated Soils Tested	Treated Slurries Tested	Treated Cores Tested	Tests to Evaluate Need for 680 Tests	Total Number of Tests Performed	Proposal Tests Scheduled for Untreated Soils	Proposal Tests Scheduled for Treated Slurries	Proposal Tests Scheduled for Field Cores	Proposal Total Number of Tests Scheduled
ANS-16.1			7		7			7	7
PCBs in ANS-16.1 (8080)			21		21			40	40
PCBs in ANS-16.1 (680)					0				0
VOC in ANS-16.1			21		21			40	40
BNAs in ANS-16.1			21		21			40	40
6 PP Metals in ANS-16.1			21		21			40	40
Oil & Grease in ANS-16.1			21		21				0
MCC-1P			8		8			7	7
PCBs in MCC-1P (8080)			19		19			40	40
PCBs in MCC-1P (680)			5		5				0
VOC in MCC-1P			19		19			40	40
BNAs in MCC-1P			19		19			40	40
6 PP Metals in MCC-1P			19		19			40	40
Oil & Grease in MCC-1P			17		17				0
PCBs by Wide Bore Capillary				14	14				0
Water TCLPs				3	3				0
TCLP on Spiked Soil Sample				1	1				0
PCBs in Water TCLPs and Spike (8080)				4	4				0
Totals	358	339	817	22	1536	247	155	546	948

cement cores used for the static leach tests produced one liter of leachate per test. This volume of extract was divided into several portions for analysis of oil and grease, BNA, VOA, metals, and PCBs analyses using Methods 8080 and 680. The sample volumes extracted for organics analysis were too small to permit detection at the limits specified in the QAPP. In many cases the detection limits were three to four times higher than specified in the QAPP.

Duplicate Analysis

Table 7-1 specifies a duplicate analysis of VOAs, but triplicate VOA vials were not prepared for solids or for TCLP Extracts, and one vial was used for the screening test so no duplicate analyses were possible for these samples.

An error was found in Table 7-1, Summary of Internal Quality Control Procedures for BNAs. Duplicate analyses are part of the method, but they were not specified. Radian analyzed duplicates for BNAs.

Matrix Spike/Matrix Spike Duplicates for Static Leach Tests

As described above, there were limited sample volumes available from the static leachates. This made it impossible to prepare any matrix spike/matrix spike duplicates. Instead, duplicate sample injections were performed, where possible.

Sample Holding Times

Due to several delays, 15 TCLP leachates for BNA analysis exceeded the holding time of 40 days from extraction to analysis as specified in the QAPP. Surrogates were added at the time the TCLP extraction was performed. Comparisons of the surrogate recoveries for BNAs from the TCLP extracts were made with the surrogate recoveries of other TCLP extracts to confirm that the integrity of the samples had not been compromised.

There was conflicting information in the QAPP regarding the holding times for VOAs. While the QAPP requires adherence to the SW-846 methods which allow a 14-day holding time for the VOA samples, it also specifically stipulated a holding time of 10 days for the VOA samples. Six samples were held beyond the 10-day limit. VOAs that were held beyond the 10-day holding time were analyzed before the 14-day holding time expired.

Chain-of-Custody Forms

About 10 unsigned chain-of-custody (COC) forms were sent with samples from the initial field sampling effort to PPK. Occasionally unsigned COC forms were sent with samples from Austin to PPK. Discussions were held between the Project Director and Field Sampling leader to be sure that later COC forms were completely filled out.

Semi-Volatile Organics Analysis

High levels of contamination were present in some of the soil samples analyzed for semi-volatile organics. It was necessary to separate these sample extracts into base/neutral and acid fractions and to then analyze the fractions separately. The QAPP assumed that all BNA samples would require only one fraction.

Replacement Samples

The samples indicated in the QAPP for analysis were not always analyzed. Duplicate or "back-up" samples were sent for the soils. However, there were no back-ups for the slurries or the cement cores. Several slurry and core samples arrived damaged and unusable. Portions of samples from the same batch (i.e., same sample site and same mix) that were designated for other analyses were used where necessary. The reported data indicate which aliquots were analyzed, although all aliquots of a given composite were presumably interchangeable.

Method 680 Holding Times

The method requires sample extraction within 7 days after collection. This could not be met due to the screening process required (using Method 8080) and because the decision as to whether to use Method 680 depended upon the acquisition of other data.

Method 680 Surrogates

The method requires carbon-labeled pesticides as surrogate compounds. Per a consultation with one of the authors of the method (Dr. Ann Alford-Stevens), Radian used carbon-labeled PCBs instead.

References

1. Klute, A., and C. Dirksen. Hydraulic Conductivity and Diffusivity: Laboratory Methods. In: Methods of Soils Analysis, Part I, A. Klute (ed.), American Society of Agronomy, and Soil Science of American Publishers. pp. 687-699.

2. Stephens, Daniel B., K. Lambert, and D. Watson "Regression Models for Hydraulic Conductivity and Field Test of Bore Hole Permeameter". Water Resources Research, Vol. 23, No. 12, pages 2207-2214. December 1987.

SECTION 3

QUALITY ASSURANCE AND QUALITY CONTROL

The objective of quality assurance and quality control (QA/QC) efforts associated with sampling and analytical activities was to ensure that data collected are of known and sufficient quality to qualitatively and quantitatively characterize the sources of interest. Two primary aspects of the overall QA/QC effort are related to achievement of this objective. First, the QA/QC program forms a framework for controlling data quality within preestablished limits during execution of the sampling and analytical efforts. Second, the QA/QC program forms the basis for estimating uncertainty in the measurement data by providing information necessary for identifying and defining qualitative and quantitative limitations associated with these data. The following sections present a brief description of some of the key elements of the QA/QC effort and an assessment of measurement data quality based on QA/QC results.

SUMMARY

Overall, QA/QC data associated with the HAZCON Demonstration Project indicate that the measurement data are acceptable and defensible. Samples were analyzed for PCBs, volatiles, semi-volatiles, metals, TCLP extracts, EP extract metals, and solids characterization. Sample matrices included soils, slurries, and cores, as well as leachates of the three major types of matrices. The most significant problem noted, from a QA/QC standpoint, was analysis for PCBs.

QA/QC data for PCB measurements by GC (Method 8080) are included in this section for historical purposes. Method 8080 proved to be unusable for most of these samples, and was used as a screening process for GC/MS analyses (Method 680). Some samples had detectable quantities of PCBs by Method 8080, however, the quantity was too low to be detected by Method 680.

These results were reported after careful evaluation of the chromatograms. However, QA/QC data for these analyses shows that these results are qualitative, not quantitative. An in-depth discussion of analysis of PCBs for the HAZCON project can be found in Appendix C of the Final Report.

Some common laboratory contaminants were detected in the reagent blank for analysis of volatile organic compounds by GC/MS (Method 8240). Methylene chloride, acetone, and benzene were the most commonly reported. These levels of contaminants should not create a problem. However, low level results of these compounds detected in field samples should be viewed with suspicion.

Semivolatile results are discussed in the last part of this section. Phthalates, which are common laboratory contaminants, were detected in the laboratory reagent blanks. Low level results for phthalates in the field samples should be viewed with caution.

In general, the metals analyses by ICPES and AA were acceptable. There were no serious contamination problems with the blanks. The matrix spike recoveries were good, and the repeatability within specifications.

Performance audit samples were prepared and submitted to the laboratories for analyses as part of this project. Results of these audits are attached as Appendix D to this section.

APPROACH

The overall QA/QC program for the study was designed to fulfill two related purposes. First, it provided an organized framework for the sampling and analytical efforts. The program was designed to control data quality within preestablished limits and to ensure that it was adequate to achieve the objectives of the program. This involved first establishing data quality objectives for the parameters of interest. Next, protocols were defined for the critical aspects of the measurement effort, including:

- Sample collection, preservation, and storage;
- Calibration of instrumentation and apparatus;
- Data reduction, validation, and reporting;
- Documentation and sample custody; and
- Analytical quality control.

These protocols were tailored such that careful adherence to the prescribed protocols would, in most cases, result in achievement of both sets of objectives.

The second purpose of a QA/QC program is to provide the mechanism for data quality assessment. Quality control data provide information for identifying and defining qualitative and quantitative limitations associated with the measurement data. The following key types of QA/QC procedures provide the primary basis for quantitatively evaluating data quality:

- Field and laboratory blank samples;
- Spiked samples; and
- Duplicate analyses.

Blank samples play an especially important role in trace analysis efforts. They provide qualitative assurance that analytes detected in the samples are actually characteristic of the media sampled and are not artifacts of the sampling and/or analytical process. Results are presented in the following sections for analysis of laboratory reagent blanks, field blanks, and extraction blanks.

Laboratory reagent blanks address only the analytical process. Typically included with each batch of samples analyzed, they provide an ongoing check of the analytical system for systematic sample contamination. When evidence of contamination is indicated by blank values above preestablished levels, corrective action is initiated to identify and eliminate the source of contamination. If possible, the affected samples may be reanalyzed.

Field blanks reflect the combined effects of sample collection, handling, transportation, storage, and analysis. Since it is often not possible to resample when field blanks indicate possible sample contamination, field blank data are more often used to define qualitative limitations of the associated measurement data. The presence of analytes of interest in either the field or laboratory blanks suggests that corresponding field samples may have been similarly contaminated and that results for these analytes should be considered suspect. If the blank data show a given analyte at widely varying concentrations, or at concentrations comparable to those for field samples, then the field sample results should be viewed as possible false positives for that analyte. If, on the other hand, blank data indicate a given analyte at concentrations much lower than typical sample concentrations, then the sample data may usually be viewed as qualitatively reliable, but as having greater than normal quantitative uncertainty.

TCLP and EP extraction blanks provide information related to contamination resulting from the TCLP process. Analytes found in TCLP blanks should be considered when interpreting results for TCLP extracts of field samples.

Two special types of spiked samples are used as part of the analytical protocol for analysis of organic compounds by gas chromatography. These are matrix spiked samples and surrogate spiked samples. Matrix spiked samples are field samples to which known amounts of the analytes of interest have been added. Typically, both a spiked and an unspiked aliquot of the sample are analyzed. The difference in results for the two analyses are calculated and compared to the amount of spike added. Since actual samples are used for the determination, any matrix effects are taken into consideration. Usually expressed as a percentage of the spike amount, spike recovery provides a measure of the accuracy of the analysis. For a single sample, this includes the combined effects of bias, or systematic error, and variability due to imprecision. Averaging spike recoveries for multiple samples tends to "average out" the random error due to imprecision and provides an estimate of analytical bias.

Surrogate spiked samples are similar to normal spiked samples except that an unspiked aliquot is not analyzed. Instead, samples are spiked with a mixture of surrogate compounds that are chemically similar to the species of interest but are not expected to be present in actual field samples. Recovery of these surrogate compounds provides an estimate of the accuracy of the method during that single analysis.

Duplicate samples and duplicate analyses are used as indicators of measurement data precision. Precision is a measure of mutual agreement among individual measurements of the same property made under prescribed similar conditions. Variability among the measurements is attributable to random error due to imprecision. In the case of duplicate analyses, the analytical process is replicated for separate aliquots of a single sample with prescribed elements of the process held constant. For example, duplicate analyses are usually performed on the same day, by the same analyst, using the same instrument and the same calibration. Differences in results for duplicate analyses are attributable to random variability in the analytical process and are a measure of analytical precision.

Duplicate samples provide another measure of precision. The analysis of duplicate samples involves replicating sample collection (and associated sample handling activities) as well as analysis, precision estimates based on duplicate sample results incorporate imprecision due to sampling variability and analytical variability.

Both duplicate sample and duplicate analysis results provide data for precision estimates. Generally, however, duplicate sample data are used in a different way than results for duplicate analyses. Since analytical precision is primarily a function of the analytical procedures used, results for duplicate analyses may be used as an ongoing quality control check. Corrective action can be initiated when results indicate that analytical

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precision is not within acceptable limits. Results for duplicate samples, on the other hand, are more often used as a data quality assessment tool. Because of the lag between sample collection and availability of analytical results, it is usually not possible to initiate corrective action based on duplicate sample data. Also, variability in duplicate sample results typically includes a component of variability attributable to inherent non-homogeneity of the sample matrix. Duplicate data of both types are useful as indicators of the degree to which results may be expected to vary by chance alone. This information is important whenever comparisons are made between measured values. Without it, it is difficult to know when to attribute observed differences to random measurement error and when to attribute them to acute differences.

For organic analyses, it is often the case that detectable levels of target analytes are not found in duplicate sample pairs, which precludes developing estimates of measurement variability. In this report, matrix spike duplicate results are used to assess repeatability. This is expressed as the coefficient of variation (CV) between duplicate spiked sample recoveries. The range of surrogate spike recoveries for a given matrix also provide a measure of analytical precision, expressed in terms of the standard deviation of percent recovery.

SOIL SAMPLES

Blank Results

Results of analytes detected in the field and reagent blanks are presented in Table 11. Reagent blank results are presented in units of ug/L. Field blanks, being actual dirt samples, are reported in mg/kg.

Beryllium, chromium, copper, nickel, silver, zinc, and lead were found in the one uncontaminated soil sample submitted as a field blank. Examination of the field sample results shows that reported levels of silver, beryllium, chromium, copper, and nickel are the same as the

TABLE 11. SUMMARY OF BLANK RESULTS FOR SOIL SAMPLES

Method Type	Parameter	Total Number of Blanks	Total Number above Detection Limit	Concentration (ug/L) Range Minimum	-	Maximum
Metals by ICPES						
Field blank (ug/kg)						
	Beryllium	1	1	0.29	-	0.29
	Chromium, total	1	1	78.0	-	78.0
	Copper	1	1	79.0	-	79.0
	Nickel	1	1	37.0	-	37.0
	Silver	1	1	0.93	-	0.93
	Zinc	1	1	57.0	-	57.0
Reagent						
	Zinc	3	1	0.70	-	0.70
Volatile Organics by GC/MS						
r						
	2-Hexanone	6	1	5.00	-	5.00
	4-Methyl-2-Pentanone	6	1	4.00	-	4.00
	Acetone	5	4	25.0	-	54
	Benzene	6	4	0.40	-	13.0
	Methylene Chloride	6	3	3.00	-	22
	Toluene	6	1	4.00	-	4.00
Atomic Absorption						
Field Blank (ug/kg)						
	Lead	1	1	120.0	-	120.0
TOC by IR						
Analytical						
	Total Organic Carbon	9	6	0.23	-	0.55
Oil & Grease by Gravimetric						
Analytical (ug/g)						
	Oil and Grease	63	21	1.56	-	58.0

uncontaminated soil. Zinc was detected in one reagent blank (0.7 ug/L). This level is less than five times the detection limit (0.2 ug/L). Review of the field data shows this level of contamination to be insignificant.

Methylene chloride was detected in the uncontaminated soil by Method 8240. However, this analyte was also detected in three of the six reagent blanks, denoted by a small "r" in Table 11. Review of the field data shows that most of the methylene chloride reported in the field samples could have come from laboratory contamination. Acetone, benzene, 2-butanone, 2-hexanone, 4-methyl-2-pentanone, and toluene were also detected in the laboratory reagent blank. Low level field blank results should be viewed with suspicion.

There were no PCBs detected in the reagent blank by Method 680.

Low levels of oil and grease were reported in the uncontaminated soil blank and in the reagent blanks for this method. Review of the field results shows that these levels of contamination are insignificant.

Total organic carbon was reported in two-thirds of the reagent blanks at levels less than five times the detection limit. Total organic carbon results for field samples should not be significantly affected by these levels of carbon.

Spiked Sample Results

Table 12 presents results of surrogate spiked samples and matrix spike samples, along with the acceptance criteria for each analyte for that type of spike. Matrix spike results are denoted by a small "m," and surrogate spike results are denoted by a small "s."

TABLE 12. SUMMARY OF SPIKE RESULTS FOR SOIL

Parameter	Number of Samples	Mean % Recovery	Standard Deviation	Number Below Acceptance Limits	Number Above Acceptance Limits	(Matrix) Acceptance Criteria
Metals by ICPES						
m						
Beryllium	6	107.5	5.08920	0	0	80.0 - 120.0
Cadmium	6	0083.0	034.93071	0	1	80.0 - 120.0
Chromium, total	6	102.3	3.66970	0	0	80.0 - 120.0
Copper	6	104.8	3.43026	0	0	80.0 - 120.0
Nickel	6	102.0	4.00000	0	0	80.0 - 120.0
Zinc	6	106.5	7.34166	0	0	80.0 - 120.0
PCBs by gc/ms						
m						
monochlorobiphenyls PCB	1	78.0		0	0	50.0 - 150.0
dichorobiphenyls PCB	1	84.0		0	0	50.0 - 150.0
trichlorobiphenyls PCB	1	85.0		0	0	50.0 - 150.0
tetrachlorobiphenyls PCB	1	77.0		0	0	50.0 - 150.0
pentachlorobiphenyls PCB	1	83.0		0	0	50.0 - 150.0
hexachlorobiphenyls PCB	1	91.0		0	0	50.0 - 150.0
heptachlorobiphenyls PCB	1	90.0		0	0	50.0 - 150.0
octachlorobiphenyls PCB	1	87.0		0	0	50.0 - 150.0
decachlorobiphenyls PCB	1	76.0		0	0	50.0 - 150.0
s						
13-C6 4-chlorobiphenyl	2	78.0	1.41421	0	0	50.0 - 150.0
13-C octachlorobiphenyl	2	53.0	48.08326	1	0	50.0 - 150.0
13-C12 decachlorobiphenyl	2	85.5	33.23402	0	0	50.0 - 150.0
Volatile Organics by GC/MS						
m						
1,1,2-Trichloroethane	2	92.0	8.48528	0	0	52.0 - 150.0
1,1-Dichloroethylene	5	75.8	5.25050	0	0	.0 - 234.0
Benzene	4	100.3	11.02031	0	0	37.0 - 151.0

TABLE 12. (Continued)

Parameter	Number of Samples	Mean % Recovery	Standard Deviation	Number Below Acceptance Limits	Number Above Acceptance Limits	(Matrix) Acceptance Criteria
Volatile Organics by GC/MS						
m						
Chlorobenzene	5	100.7	16.15898	0	0	37.0 - 160.0
Toluene	5	103.9	12.82763	0	0	47.0 - 150.0
Trichloroethylene	5	81.0	12.96496	1	0	71.0 - 157.0
1,2-dichloroethane-d4	28	90.0	10.08292	3	0	70.0 - 121.0
Bromofluorobenzene	28	94.4	10.57400	0	0	74.0 - 121.0
Toluene - d8	29	106.2	16.02915	0	4	81.0 - 117.0
Atomic Absorption						
m						
Mercury	6	107.2	7.49444	0	0	80.0 - 120.0
graphite furnace						
m						
Arsenic	6	100.2	3.48807	0	0	80.0 - 120.0
Selenium	4	101.8	2.50000	0	0	80.0 - 120.0
Thallium	6	105.8	8.23205	0	0	80.0 - 120.0

Matrix spike results for metals are within the 100±20% acceptance criteria specified by the QAPP for spiked samples. One sample for cadmium was above these limits; however, the mean result for this element is within the acceptance criteria.

Recovery for trichloroethylene was outside the matrix spike acceptance criteria (71-157% recovery) for one out of five matrix spiked samples. Poor recovery for one matrix spike analyte in one analysis should not be considered a major problem.

Surrogate recovery for this analysis was generally quite good. Recovery of 1,2-dichloroethane-d4 was slightly below the acceptance criteria (70-121% recovery) specified by EPA's Contract Laboratory Program (CLP) for 3 of 28 samples. These recoveries do not suggest significant matrix effects for field sample results.

One sample was spiked for matrix spike analysis of PCBs by GC/MS. Recovery for all nine matrix spike compounds was within the acceptance criteria of 100 ±50% recovery. Surrogate spike recoveries were within acceptance criteria (100 ±50% recovery) for all analytes but one (13-C-octachlorobiphenyl).

Duplicate Sample Results

Duplicate sample results for soil samples are presented in Table 13. The mean concentration of the samples is calculated, as well as the standard deviation and coefficient of variation for those results.

Results for matrix spike duplicate samples for metals show excellent repeatability. The coefficient of variation was less than 5% for all compounds.

TABLE 13. LAB DUPLICATE (SAMPLES OR ANALYSES) FOR SOIL SAMPLES

Parameter	Routine Sample ID	Duplicate Sample ID	Routine Value	Duplicate Value	Mean Concentration	Standard Deviation	% CV
Metals by ICPES							
Beryllium	S7-11-038	S7-11-038_dup	105.00000	103.00000	104.00000	1.41421	1.35982
Beryllium	S7-11-035	S7-11-035_dup	114.00000	114.00000	114.00000	0.00000	0.00000
Beryllium	S7-11-080	S7-11-038_dup	104.00000	105.00000	104.50000	0.70711	0.67666
Cadmium	S7-11-038	S7-11-038_dup	97.00000	95.00000	96.00000	1.41421	1.47314
Cadmium	S7-11-080	S7-11-038_dup	100.00000	99.00000	99.50000	0.70711	0.71066
Cadmium	S7-11-035	S7-11-035_dup	103.00000	103.00000	103.00000	0.00000	0.00000
Chromium, total	S7-11-035	S7-11-035_dup	108.00000	107.00000	107.50000	0.70711	0.65777
Chromium, total	S7-11-080	S7-11-038_dup	100.00000	100.00000	100.00000	0.00000	0.00000
Chromium, total	S7-11-038	S7-11-038_dup	101.00000	99.00000	100.00000	1.41421	1.41421
Copper	S7-11-038	S7-11-038_dup	104.00000	100.00000	102.00000	2.82843	2.77297
Copper	S7-11-080	S7-11-038_dup	103.00000	105.00000	104.00000	1.41421	1.35982
Copper	S7-11-035	S7-11-035_dup	107.00000	110.00000	108.50000	2.12132	1.95513
Nickel	S7-11-080	S7-11-038_dup	99.00000	101.00000	100.00000	1.41421	1.41421
Nickel	S7-11-038	S7-11-038_dup	100.00000	98.00000	99.00000	1.41421	1.42850
Nickel	S7-11-035	S7-11-035_dup	107.00000	107.00000	107.00000	0.00000	0.00000
Zinc	S7-11-035	S7-11-035_dup	105.00000	107.00000	106.00000	1.41421	1.33416
Zinc	S7-11-080	S7-11-038_dup	111.00000	118.00000	114.50000	4.94975	4.32292
Zinc	S7-11-038	S7-11-038_dup	100.00000	98.00000	99.00000	1.41421	1.42850
PCBs by gc/ms							
monochlorobiphenyls PCB	P8-02-002	P8-02-002_dup	68.00000	80.00000	74.00000	8.48528	11.46660
dichorobiphenyls PCB	P8-02-002	P8-02-002_dup	83.00000	82.00000	82.50000	0.70711	0.85710
trichlorobiphenyls PCB	P8-02-002	P8-02-002_dup	82.00000	85.00000	83.50000	2.12132	2.54050
tetrachlorobiphenyls PCB	P8-02-002	P8-02-002_dup	71.00000	77.00000	74.00000	4.24264	5.73330
pentachlorobiphenyls PCB	P8-02-002	P8-02-002_dup	81.00000	83.00000	82.00000	1.41421	1.72465
hexachlorobiphenyls PCB	P8-02-002	P8-02-002_dup	89.00000	91.00000	90.00000	1.41421	1.57135
heptachlorobiphenyls PCB	P8-02-002	P8-02-002_dup	87.00000	90.00000	88.50000	2.12132	2.39697
octachlorobiphenyls PCB	P8-02-002	P8-02-002_dup	82.00000	87.00000	84.50000	3.53553	4.18406
decachlorobiphenyls PCB	P8-02-002	P8-02-002_dup	72.00000	76.00000	74.00000	2.82843	3.82220

TABLE 13. (Continued)

Parameter	Routine Sample ID	Duplicate Sample ID	Routine Value	Duplicate Value	Mean Concentration	Standard Deviation	I CV
Volatile Organics by GC/MS							
1,1,1-Trichloroethane	S7-11-004	S7-11-004_dup	114.00000	109.00000	111.50000	3.53553	3.17088
1,1,2,2-Tetrachloroethane	S7-11-004	S7-11-004_dup	118.00000	112.00000	115.00000	4.24264	3.68925
1,1,2-Trichloroethane	S7-11-004	S7-11-004_dup	34.00000	34.00000	34.00000	0.00000	0.00000
1,1-Dichloroethane	S7-11-004	S7-11-004_dup	77.00000	81.00000	79.00000	2.82843	3.58029
1,1-Dichloroethylene	S7-10-139	S7-10-139_dup	77.00000	67.00000	72.00000	7.07107	9.82093
1,1-Dichloroethylene	S7-11-004	S7-11-004_dup	87.00000	97.00000	92.00000	7.07107	7.68594
1,2-Dichloroethane	S7-11-004	S7-11-004_dup	93.00000	102.00000	97.50000	6.36396	6.52714
1,2-Dichloropropane	S7-11-004	S7-11-004_dup	96.00000	92.00000	94.00000	2.82843	3.00897
1,2-Trans-Dichloroethylene	S7-11-004	S7-11-004_dup	108.00000	119.00000	113.50000	7.77817	6.85302
1,3-Dichloropropylene	S7-11-004	S7-11-004_dup	102.00000	97.00000	99.50000	3.53553	3.55330
Acetone	S7-10-139	S7-10-139_dup	3.00000	4.00000	3.50000	0.70711	20.20305
Acetone	S7-11-004	S7-11-004_dup	18.00000	15.00000	16.50000	2.12132	12.85649
Benzene	S7-10-139	S7-10-139_dup	8.00000	5.00000	6.50000	2.12132	32.63570
Benzene	S7-10-139	S7-10-139_dup	86.00000	98.00000	92.00000	8.48528	9.22313
Benzene	S7-11-004	S7-11-004_dup	110.00000	108.00000	109.00000	1.41421	1.29744
Bromoform	S7-11-004	S7-11-004_dup	123.00000	123.00000	123.00000	0.00000	0.00000
Carbon Disulfide	S7-11-004	S7-11-004_dup	2.40000	2.10000	2.25000	0.21213	9.42809
Carbon Tetrachloride	S7-11-004	S7-11-004_dup	115.00000	110.00000	112.50000	3.53553	3.14270
Chlorobenzene	S7-10-139	S7-10-139_dup	85.00000	99.00000	92.00000	9.89949	10.76032
Chlorobenzene	S7-11-004	S7-11-004_dup	119.00000	115.00000	117.00000	2.82843	2.41746
Chlorodibromomethane	S7-11-004	S7-11-004_dup	101.00000	99.00000	100.00000	1.41421	1.41421
Chloroethane	S7-11-004	S7-11-004_dup	149.00000	118.00000	133.50000	21.92031	16.41971
Chloroform	S7-11-004	S7-11-004_dup	99.00000	112.00000	105.50000	9.19239	8.71316
Dichlorobromomethane	S7-11-004	S7-11-004_dup	102.00000	99.00000	100.50000	2.12132	2.11077
Ethylbenzene	S7-11-004	S7-11-004_dup	126.00000	119.00000	122.50000	4.94975	4.04061
Methylene Chloride	S7-10-139	S7-10-139_dup	5.00000	5.00000	5.00000	0.00000	0.00000
Methylene Chloride	S7-11-004	S7-11-004_dup	2.50000	1.90000	2.20000	0.42426	19.28473
Methylene Chloride	S7-11-004	S7-11-004_dup	83.00000	76.00000	79.50000	4.94975	6.22610
Styrene	S7-11-004	S7-11-004_dup	6.40000	6.10000	6.25000	0.21213	3.39411
Tetrachloroethylene	S7-11-004	S7-11-004_dup	93.00000	89.00000	91.00000	2.82843	3.10816

TABLE 13. (Continued)

Parameter	Routine Sample ID	Duplicate Sample ID	Routine Value	Duplicate Value	Mean Concentration	Standard Deviation	% CV
Toluene	S7-10-139	S7-10-139_dup	2.00000	1.00000	1.50000	0.70711	47.14045
Toluene	S7-11-004	S7-11-004_dup	99.00000	85.00000	92.00000	9.89949	10.76032
Toluene	S7-10-139	S7-10-139_dup	107.00000	115.00000	111.00000	5.65685	5.09627
Trichloroethylene	S7-11-004	S7-11-004_dup	96.00000	92.00000	94.00000	2.82843	3.00897
Trichloroethylene	S7-10-139	S7-10-139_dup	65.00000	76.00000	70.50000	7.77817	11.03287
Trichlorofluoromethane	S7-11-004	S7-11-004_dup	83.00000	93.00000	88.00000	7.07107	8.03530
Trichlorofluoromethane	S7-10-139	S7-10-139_dup	1.00000	1.00000	1.00000	0.00000	0.00000
Vinyl Chloride	S7-11-004	S7-11-004_dup	182.00000	160.00000	171.00000	15.55635	9.09728
Atomic Absorption							
Mercury	S7-11-038	S7-11-038_dup	100.00000	110.00000	105.00000	7.07107	6.73435
Mercury	S7-11-035	S7-11-035_dup	105.00000	100.00000	102.50000	3.53553	3.44930
Mercury	S7-11-080	S7-11-080_dup	120.00000	125.00000	122.50000	3.53553	2.88615
graphite furnace							
Arsenic	S7-11-035	S7-11-035_dup	102.00000	102.00000	102.00000	0.00000	0.00000
Arsenic	S7-11-038	S7-11-038_dup	99.00000	94.00000	96.50000	3.53553	3.66377
Arsenic	S7-11-080	S7-11-080_dup	100.00000	104.00000	102.00000	2.82843	2.77297
Selenium	S7-11-035	S7-11-035_dup	108.00000	103.00000	105.50000	3.53553	3.35122
Selenium	S7-11-038	S7-11-038_dup	103.00000	103.00000	103.00000	0.00000	0.00000
Thallium	S7-11-035	S7-11-035_dup	115.00000	115.00000	115.00000	0.00000	0.00000
Thallium	S7-11-080	S7-11-080_dup	96.00000	108.00000	102.00000	8.48528	8.31890
Thallium	S7-11-038	S7-11-038_dup	103.00000	98.00000	100.50000	3.53553	3.51794

TABLE 13. (Continued)

Parameter	Routine Sample ID	Duplicate Sample ID	Routine Value	Duplicate Value	Mean Concentration	Standard Deviation	% CV
Oil & Grease by Gravimetric							
Oil and Grease	8710123	8710123_dup	4889.00000	5537.80000	5213.40000	458.77088	8.79984
Oil and Grease	8710123	8710123_dup	79869.00000	83812.00000	81840.50000	2788.12204	3.40678
Oil and Grease	8801088	8801088_dup	0.40000	0.40000	ND	NC	NC
Oil and Grease	8801088	8801088_dup	0.40000	0.40000	ND	NC	NC
Oil and Grease	8801121	8801121_dup	2.40000	2.50000	2.45000	0.07071	2.88615
Oil and Grease	8801120	8801120_dup	1.30000	1.50000	1.40000	0.14142	10.10153
Oil and Grease	8801121	8801121_dup	0.95000	0.92000	0.93500	0.02121	2.26879
Oil and Grease	8801120	8801120_dup	1.30000	1.30000	1.30000	0.00000	0.00000
Oil and Grease	8801088	8801088_dup	0.40000	0.40000	ND	NC	NC
Oil and Grease	8801060	8801060_dup	7.80000	7.80000	7.80000	0.00000	0.00000
Oil and Grease	8801052	8801052_dup	44.00000	44.00000	44.00000	0.00000	0.00000
Oil and Grease	8801020	8801020_dup	5.80000	5.80000	5.80000	0.00000	0.00000
Oil and Grease	8801020	8801020_dup	13.00000	13.00000	13.00000	0.00000	0.00000
Oil and Grease	8801027	8801027_dup	3.30000	3.30000	3.30000	0.00000	0.00000
Oil and Grease	8711143	8711143_dup	105976.00000	106061.00000	106018.50000	60.10408	0.05669
Oil and Grease	8710123	8710123_dup	65000.00000	61883.00000	63441.50000	2204.05184	3.47415

NC: Not Calculable

Repeatability for volatile organic analyses was also good. The coefficient of variation was less than 50% for all compounds, which is the acceptance criteria specified by the method.

Repeatability of matrix spike results of PCBs by GC/MS show repeatability within 10% for all compounds. These results are well within the acceptance limits of 50% RPD.

Results for oil and grease were good. They ranged from 0 to 10% coefficient of variation.

SOIL LEACHATES

Blank Results

Results of compounds detected in the reagent blank above the detection limit are presented in Table 14.

Acetone was detected by Method 8240 in two samples, slightly above the detection limit (5 ug/L). Low levels of acetone in the field samples may be caused by laboratory contamination. Benzene was detected in one reagent blank below the limit of quantitation. This level of contamination should not affect field sample results.

Metals and PCBs were not detected in the reagent blanks.

Spiked Sample Results

Spiked sample results are summarized in Table 15, along with the acceptance criteria for each method. Matrix spike results are denoted by a small "r," and surrogate spike results are denoted by a small "s."

TABLE 14. SUMMARY OF LABORATORY BLANK RESULTS FOR SOIL LEACHATES

Method Type	Parameter	Total Number of Blanks	Total Number above Detection Limit	Concentration (ug/L) Range Minimum	-	Maximum
Volatile Organics by GC/MS						
Reagent						
	Acetone	2	2	2.70	-	6.60
	Benzene	2	1	1.70	-	1.70

TABLE 15. SUMMARY OF SPIKE RESULTS FOR SOIL LEACHATES

Parameter	Number of Samples	Mean % Recovery	Standard Deviation	Number Below Acceptance Limits	Number Above Acceptance Limits	(Matrix) Acceptance Criteria
PCBs by GC						
m						
Lindane	2	191.0	21.21320	0	2	50.0 - 150.0
Heptachlor	2	202.5	23.33452	0	2	50.0 - 150.0
Aldrin	2	97.0	8.48528	0	2	50.0 - 150.0
Dieldrin	2	55.5	2.12132	0	2	50.0 - 150.0
Endrin	2	97.0	7.07107	0	2	50.0 - 150.0
4,4'-DDT	2	280.5	149.19953	0	2	50.0 - 150.0
s						
Dibutyl chlorendate	7	89.3	73.01076	0	6	50.0 - 150.0
Volatile Organics by GC/MS						
m						
1,1-Dichloroethylene	2	72.5	2.12132	0	0	.0 - 234.0
Benzene	2	114.0	1.41421	0	0	37.0 - 151.0
Chlorobenzene	2	106.5	.70711	0	0	37.0 - 160.0
Toluene	2	85.0	.00000	0	0	47.0 - 150.0
Trichloroethylene	2	96.5	2.12132	0	0	71.0 - 157.0
s						
1,2-dichloroethane-d4	18	94.6	8.32588	0	0	70.0 - 121.0
Bromofluorobenzene	17	98.4	8.71822	0	1	74.0 - 121.0
Toluene - d8	8	93.0	5.12696	0	0	81.0 - 117.0

TABLE 15. (Continued)

Parameter	Number of Samples	Mean X Recovery	Standard Deviation	Number Below Acceptance Limits	Number Above Acceptance Limits	(Matrix) Acceptance Criteria
metals by ic						
m						
Cadmium	3	85.3	2.51661	0	0	80.0 - 120.0
Chromium, total	3	86.3	5.70117	1	0	80.0 - 120.0
Copper	3	92.7	5.68624	0	0	80.0 - 120.0
Nickel	3	58.6	43.13096	1	0	80.0 - 120.0
Zinc	3	85.0	5.00000	0	0	80.0 - 120.0
PCBs by gc/ms						
s						
13-C6 4-chlorobiphenyl	11	50.0	6.49615	4	0	50.0 - 150.0
13-C octachlorobiphenyl	11	71.5	16.87817	0	0	50.0 - 150.0
13-C12 decachlorobiphenyl	11	33.1	4.34637	11	0	50.0 - 150.0
Lead by AA						
m						
Lead	3	176.7	142.24392	0	0	80.0 - 120.0

Recovery of matrix spike compounds for metals was acceptable for all compounds analyzed by ICPES, except one spike result for chromium and one spike result for nickel. Recoveries within 80-120% of the theoretical value were expected. Matrix spike recovery of lead in soil leachates averaged 177%. Field results for this element in this matrix may be biased slightly high.

Method 8240 matrix spike and surrogate spike compounds were within the acceptance criteria specified by the method for all analytes except one. Bromofluorobenzene recovery was above the acceptance criteria of 74-121% for one of 17 surrogate spike results.

Matrix spike and surrogate recoveries for PCBs were highly variable for this matrix type. Analyses of PCBs by GC is summarized in the first part of this section.

Surrogate spike recovery of samples analyzed for PCBs by GC/MS were low (30%) for the higher molecular weight surrogate compounds. This implies that the detection limit for these compounds could be slightly higher than the laboratory reported. Recovery for the lower weight surrogate compounds averaged 50%.

Duplicate Results

Table 16 summarizes the results for laboratory duplicates of PCBs by GC, volatile organics by GC/MS, and oil and grease by IR. PCB results show high variability for three of the five matrix spike duplicate compounds. These results are not unexpected considering the sample matrix.

Repeatability of matrix spike duplicate compounds was well inside the accuracy objectives (RPD $\leq$ 50%) stated by the QAPP for all five of the matrix spike compounds.

TABLE 16. LAB DUPLICATE (SAMPLES OR ANALYSES) FOR SOIL LEACHATES

Parameter	Routine Sample ID	Duplicate Sample ID	Routine Value	Duplicate Value	Mean Concentration	Standard Deviation	% CV
PCBs by GC							
Lindane	P7-10-039	P7-10-039_dup	176.00000	206.00000	191.00000	21.21320	11.10639
Heptachlor	P7-10-039	P7-10-039_dup	186.00000	219.00000	202.50000	23.33452	11.52322
Dieldrin	P7-10-039	P7-10-039_dup	57.00000	54.00000	55.50000	2.12132	3.82220
Endrin	P7-10-039	P7-10-039_dup	102.00000	92.00000	97.00000	7.07107	7.28976
4,4'-DDT	P7-10-039	P7-10-039_dup	175.00000	386.00000	280.50000	149.19953	53.19056
Volatile Organics by GC/MS							
1,1-Dichloroethylene	S7-11-060	S7-11-060_dup	74.00000	71.00000	72.50000	2.12132	2.92596
Benzene	S7-11-060	S7-11-060_dup	115.00000	113.00000	114.00000	1.41421	1.24054
Chlorobenzene	S7-11-060	S7-11-060_dup	107.00000	106.00000	106.50000	0.70711	0.66395
Toluene	S7-11-060	S7-11-060_dup	85.00000	96.00000	90.50000	7.77817	8.59467
Trichloroethylene	S7-11-060	S7-11-060_dup	98.00000	95.00000	96.50000	2.12132	2.19826
HC by IR							
Petroleum Hydrocarbons	8801156	8801156_dup	3.30000	3.50000	3.40000	0.14142	4.15945
Petroleum Hydrocarbons	8802078	8802078_dup	5.30000	5.30000	5.30000	0.00000	0.00000
Petroleum Hydrocarbons	8801156	8801156_dup	3.50000	3.30000	3.40000	0.14142	4.15945

Oil and grease results for duplicate samples show good repeatability, with results less than 5% CV for three samples.

SLURRY SAMPLE RESULTS

Blank Results

There were no analytes detected in the reagent blank compounds above the detection limit.

Spiked Sample Results

Matrix spike and surrogate spike recovery data for samples analyzed by Method 8240 is summarized in Table 17. These results show that for most samples the surrogate recoveries were within the accuracy objectives specified by CLP. For 1,2-dichloroethane-d4, recovery was below the acceptance limits (76-114% recovery) for two samples, and above the acceptance limits for four samples. For bromofluorobenzene, recovery was below the acceptance limits (86-115%) for six samples, and above the acceptance limits for six samples. For toluene-d8, recovery was above the acceptance limits (88-110% recovery) for nine samples. These recoveries should not significantly affect the results.

Matrix spike results for volatile organics were within the accuracy objectives specified by CLP for all analytes except for 1,1-dichloroethane and toluene. Recovery for 1,1-dichloroethane was below the accuracy objectives of 49-155% recovery for one sample. Recovery of toluene was above the accuracy objectives of 47-150% for two samples.

TABLE 17. SUMMARY OF SPIKE RESULTS FOR SLURRY SAMPLES

Parameter	Number of Samples	Mean % Recovery	Standard Deviation	Number Below Acceptance Limits	Number Above Acceptance Limits	(Matrix) Acceptance Criteria
Volatile Organics by GC/MS						
m						
1,1,1-Trichloroethane	2	110.5	.70711	0	0	52.0 - 162.0
1,1,2,2-Tetrachloroethane	2	95.0	4.24264	0	0	46.0 - 157.0
1,1,2-Trichloroethane	2	100.0	2.82843	0	0	52.0 - 150.0
1,1-Dichloroethane	2	46.5	3.53553	1	0	49.0 - 155.0
1,1-Dichloroethylene	6	84.8	29.78199	0	0	.0 - 234.0
1,2-Dichloroethane	2	54.5	2.12132	0	0	49.0 - 155.0
1,2-Dichloropropane	2	75.0	.00000	0	0	.0 - 210.0
1,2-Trans-Dichloroethylene	2	65.5	2.12132	0	0	54.0 - 156.0
1,3-Dichloropropylene	2	81.0	2.82843	0	0	17.0 - 183.0
Benzene	6	91.5	4.13521	0	0	37.0 - 151.0
Bromoform	2	129.5	4.94975	0	0	45.0 - 169.0
Carbon Tetrachloride	2	103.0	1.41421	0	0	70.0 - 140.0
Chlorobenzene	6	90.5	3.14643	0	0	37.0 - 160.0
Chlorodibromomethane	2	87.0	2.82843	0	0	53.0 - 149.0
Chloroethane	2	58.0	1.41421	0	0	50.0 - 150.0
Chloroform	2	63.0	.00000	0	0	51.0 - 138.0
Dichlorobromomethane	2	97.0	2.82843	0	0	35.0 - 155.0
Ethylbenzene	2	91.5	.70711	0	0	37.0 - 162.0
Methylene Chloride	2	49.0	.00000	0	0	.0 - 221.0
Tetrachloroethylene	2	94.5	6.36396	0	0	64.0 - 148.0
Toluene	6	118.7	34.59287	0	2	47.0 - 150.0
Trichloroethylene	6	84.0	6.72309	0	0	71.0 - 157.0
Trichlorofluoromethane	2	46.5	2.12132	0	0	17.0 - 181.0
Vinyl Chloride	2	62.0	1.41421	0	0	.0 - 251.0
1,2-dichloroethane-d4	40	96.1	11.40355	2	4	76.0 - 114.0
Bromofluorobenzene	40	103.8	23.21680	6	6	86.0 - 115.0
Toluene - d8	31	106.7	9.34592	0	9	88.0 - 110.0

Duplicate Sample Analysis

Duplicate sample results for Method 8240 analysis of slurry samples is presented in Table 18. Results for all compounds but one were within the accuracy objectives (RPD $\leq$50%) specified by the QAPP. Methylene chloride was reported as 34 ug/L and 81 ug/L, giving a CV of 58%.

SLURRY LEACHATE SAMPLES

Blank Results

Results of analytes detected in the reagent blanks are presented in Table 19.

Acetone was detected in three of the five reagent blanks for Method 8240. This should not affect the field results since the level of contamination was below five times the detection limit.

There were no metals or PCBs detected in the reagent blanks.

Spiked Sample Results

Spiked sample results are presented in Table 20.

For metals analyses, recoveries within 80-120% of the theoretical value were expected. There were nine matrix spike samples for the six priority pollutant metals. All recoveries were within the acceptance criteria.

For Method 8240, there were four matrix spike samples spiked with 5 different compounds. Trichloroethylene was below the accuracy objective (71-157%) for two of the four samples. All of the other compounds were within the accuracy objectives.

TABLE 18. LAB DUPLICATE (SAMPLES OR ANALYSES) FOR SLURRY SAMPLES

Parameter	Routine Sample ID	Duplicate Sample ID	Routine Value	Duplicate Value	Mean Concentration	Standard Deviation	% CV
1,1,1-Trichloroethane	S7-10-139	S7-10-139_dup	2000.00000	1600.00000	1800.00000	282.84271	15.71348
1,1,1-Trichloroethane	S7-10-161	S7-10-161_dup	7.50000	11.50000	9.50000	2.82843	29.77292
1,1,1-Trichloroethane	S7-10-161	S7-10-161_dup	111.00000	110.00000	110.50000	0.70711	0.63992
1,1,2,2-Tetrachloroethane	S7-10-161	S7-10-161_dup	92.00000	98.00000	95.00000	4.24264	4.46594
1,1,2-Trichloroethane	S7-10-161	S7-10-161_dup	98.00000	102.00000	100.00000	2.82843	2.82843
1,1-Dichloroethane	P7-12-014	P7-12-014_dup	116.00000	84.00000	100.00000	22.62742	22.62742
1,1-Dichloroethane	P7-12-014	P7-12-014_dup	115.00000	107.00000	111.00000	5.65685	5.09627
1,1-Dichloroethane	S7-10-161	S7-10-161_dup	49.00000	44.00000	46.50000	3.53553	7.60330
1,1-Dichloroethylene	S7-10-161	S7-10-161_dup	53.00000	48.00000	50.50000	3.53553	7.00106
1,1-Dichloroethylene	S7-10-139	S7-10-139_dup	86.00000	91.00000	88.50000	3.53553	3.99495
1,1-Dichloroethylene	S7-11-043	S7-11-043_dup	107.00000	124.00000	115.50000	12.02082	10.40763
1,2-Dichloroethane	S7-10-161	S7-10-161_dup	56.00000	53.00000	54.50000	2.12132	3.89233
1,2-Dichloropropane	S7-10-161	S7-10-161_dup	75.00000	75.00000	75.00000	0.00000	0.00000
1,2-Trans-Dichloroethylene	S7-10-161	S7-10-161_dup	67.00000	64.00000	65.50000	2.12132	3.23866
1,3-Dichloropropylene	S7-10-161	S7-10-161_dup	83.00000	79.00000	81.00000	2.82843	3.49189
2-Butanone	S7-10-161	S7-10-161_dup	210.00000	140.00000	175.00000	49.49747	28.28427
2-Butanone	S7-10-139	S7-10-139_dup	8100.00000	8400.00000	8250.00000	212.13203	2.57130
2-Hexanone	S7-10-139	S7-10-139_dup	6400.00000	6800.00000	6600.00000	282.84271	4.28550
2-Hexanone	S7-10-161	S7-10-161_dup	210.00000	125.00000	167.50000	60.10408	35.88303
4-Methyl-2-Pentanone	S7-10-161	S7-10-161_dup	180.00000	90.00000	135.00000	63.63961	47.14045
4-Methyl-2-Pentanone	S7-10-139	S7-10-139_dup	13000.00000	14000.00000	13500.00000	707.10678	5.23783
Acetone	S7-10-139	S7-10-139_dup	4100.00000	4000.00000	4050.00000	70.71068	1.74594
Acetone	S7-10-161	S7-10-161_dup	730.00000	540.00000	635.00000	134.35029	21.15753
Benzene	P7-12-014	P7-12-014_dup	97.00000	88.00000	92.50000	6.36396	6.87996
Benzene	S7-11-043	S7-11-043_dup	92.00000	99.00000	95.50000	4.94975	5.18298
Benzene	S7-10-139	S7-10-139_dup	87.00000	90.00000	88.50000	2.12132	2.39697
Benzene	S7-10-161	S7-10-161_dup	89.00000	92.00000	90.50000	2.12132	2.34400
Benzene	P7-12-014	P7-12-014_dup	109.00000	104.00000	106.50000	3.53553	3.31975
Bromoform	S7-10-161	S7-10-161_dup	126.00000	133.00000	129.50000	4.94975	3.82220
Carbon Tetrachloride	S7-10-139	S7-10-139_dup	640.00000	620.00000	630.00000	14.14214	2.24478
Carbon Tetrachloride	S7-10-161	S7-10-161_dup	102.00000	104.00000	103.00000	1.41421	1.37302

TABLE 18. (Continued)

Parameter	Routine Sample ID	Duplicate Sample ID	Routine Value	Duplicate Value	Mean Concentration	Standard Deviation	% CV
Chlorobenzene	S7-10-139	S7-10-139_dup	92.00000	92.00000	92.00000	0.00000	0.00000
Chlorobenzene	P7-12-014	P7-12-014_dup	93.00000	91.00000	92.00000	1.41421	1.53719
Chlorobenzene	P7-12-014	P7-12-014_dup	81.00000	75.00000	78.00000	4.24264	5.43928
Chlorobenzene	S7-10-161	S7-10-161_dup	91.00000	89.00000	90.00000	1.41421	1.57135
Chlorobenzene	S7-11-043	S7-11-043_dup	85.00000	94.00000	89.50000	6.36396	7.11057
Chlorodibromomethane	S7-10-161	S7-10-161_dup	85.00000	89.00000	87.00000	2.82843	3.25107
Chloroethane	S7-10-161	S7-10-161_dup	59.00000	57.00000	58.00000	1.41421	2.43830
Chloroform	S7-10-139	S7-10-139_dup	160.00000	200.00000	180.00000	28.28427	15.71348
Chloroform	S7-10-161	S7-10-161_dup	63.00000	63.00000	63.00000	0.00000	0.00000
Dichlorobromomethane	S7-10-161	S7-10-161_dup	95.00000	99.00000	97.00000	2.82843	2.91590
Ethylbenzene	S7-10-161	S7-10-161_dup	160.00000	150.00000	155.00000	7.07107	4.56198
Ethylbenzene	S7-10-139	S7-10-139_dup	17000.00000	16000.00000	16500.00000	707.10678	4.28550
Ethylbenzene	S7-10-161	S7-10-161_dup	92.00000	91.00000	91.50000	0.70711	0.77279
Methylene Chloride	S7-10-161	S7-10-161_dup	49.00000	46.00000	47.50000	2.12132	4.46594
Methylene Chloride	S7-10-139	S7-10-139_dup	420.00000	280.00000	350.00000	98.99495	28.28427
Methylene Chloride	S7-10-161	S7-10-161_dup	34.00000	81.00000	57.50000	33.23402	57.79829
Tetrachloroethylene	S7-10-161	S7-10-161_dup	480.00000	500.00000	490.00000	14.14214	2.88615
Tetrachloroethylene	S7-10-139	S7-10-139_dup	6800.00000	6100.00000	6450.00000	494.97475	7.67403
Tetrachloroethylene	S7-10-161	S7-10-161_dup	99.00000	90.00000	94.50000	6.36396	6.73435
Toluene	P7-12-014	P7-12-014_dup	138.00000	136.00000	137.00000	1.41421	1.03227
Toluene	S7-11-043	S7-11-043_dup	84.00000	96.00000	90.00000	8.48528	9.42809
Toluene	S7-10-161	S7-10-161_dup	168.00000	155.00000	161.50000	9.19239	5.69188
Toluene	S7-10-161	S7-10-161_dup	400.00000	290.00000	345.00000	77.78175	22.54543
Toluene	S7-10-139	S7-10-139_dup	26000.00000	33000.00000	29500.00000	4949.74747	16.77880
Toluene	P7-12-014	P7-12-014_dup	94.00000	77.00000	85.50000	12.02082	14.05943
Toluene	S7-10-139	S7-10-139_dup	97.00000	112.00000	104.50000	10.60660	10.14986
Total Xylenes	S7-10-139	S7-10-139_dup	100000.00000	87000.00000	93500.00000	9192.38816	9.83143
Total Xylenes	S7-10-161	S7-10-161_dup	1400.00000	1300.00000	1350.00000	70.71068	5.23783
Trichloroethylene	S7-10-161	S7-10-161_dup	89.00000	90.00000	89.50000	0.70711	0.79006
Trichloroethylene	S7-11-043	S7-11-043_dup	82.00000	90.00000	86.00000	5.65685	6.57774
Trichloroethylene	P7-12-014	P7-12-014_dup	151.00000	151.00000	151.00000	0.00000	0.00000

TABLE 18. (Continued)

Parameter	Routine Sample ID	Duplicate Sample ID	Routine Value	Duplicate Value	Mean Concentration	Standard Deviation	% CV
Trichloroethylene	P7-12-014	P7-12-014_dup	131.00000	122.00000	126.50000	6.36396	5.03080
Trichloroethylene	S7-10-139	S7-10-139_dup	74.00000	79.00000	76.50000	3.53553	4.62161
Trichloroethylene	S7-10-139	S7-10-139_dup	13000.00000	13000.00000	13000.00000	0.00000	0.00000
Trichlorofluoromethane	S7-10-161	S7-10-161_dup	48.00000	45.00000	46.50000	2.12132	4.56198
Vinyl Chloride	S7-10-161	S7-10-161_dup	61.00000	63.00000	62.00000	1.41421	2.28099

TABLE 19. SUMMARY OF LABORATORY BLANK RESULTS FOR SLURRY LEACHATE SAMPLES

Method Type	Parameter	Total Number of Blanks	Total Number above Detection Limit	Concentration (ug/L) Range Minimum - Maximum	
Volatile Organics by GC/MS					
Reagent					
	Acetone	5	3	6.00 - 12.0	7.50

TABLE 20. SUMMARY OF SPIKE RESULTS FOR SLURRY LEACHATE SAMPLES

Parameter	Number of Samples	Mean % Recovery	Standard Deviation	Number Below Acceptance Limits	Number Above Acceptance Limits	(Matrix) Acceptance Criteria
metals by ic						
m						
Cadmium	9	91.2	2.04803	0	0	80.0 - 120.0
Chromium, total	9	89.7	2.69258	0	0	80.0 - 120.0
Copper	9	94.8	10.89470	0	0	80.0 - 120.0
Nickel	9	90.4	4.12647	0	0	80.0 - 120.0
Zinc	9	92.9	3.17980	0	0	80.0 - 120.0
Volatile Organics by GC/MS						
m						
1,1-Dichloroethylene	4	58.8	18.76832	0	0	.0 - 234.0
Benzene	4	100.0	15.72683	0	0	37.0 - 151.0
Chlorobenzene	4	96.3	3.77492	0	0	37.0 - 160.0
Toluene	4	112.3	17.28921	0	0	47.0 - 150.0
Trichloroethylene	4	71.5	9.32738	2	0	71.0 - 157.0
s						
1,2-dichloroethane-d4	7	103.9	2.79455	0	0	70.0 - 121.0
Bromofluorobenzene	7	98.3	11.94033	0	0	74.0 - 121.0
Toluene - d8	15	103.9	4.51136	0	0	81.0 - 117.0
graphite furnace						
m						
Lead	9	84.8	17.96370	0	0	80.0 - 120.0
PCBs by gc/ms						
s						
13-C6 4-chlorobiphenyl	12	61.3	18.69917	5	0	50.0 - 150.0
13-C octachlorobiphenyl	12	63.3	12.64432	0	0	50.0 - 150.0
13-C12 decachlorobiphenyl	12	37.9	12.46419	8	0	50.0 - 150.0

Surrogate recoveries for Method 8240 were quite good, with recoveries inside the accuracy objectives for all three surrogate compounds in all samples.

For Method 680, higher molecular weight surrogates were recovered at about 38% recovery. This suggests that the detection limit for these compounds may be higher than stated by the laboratory. Recovery of the lower molecular weight surrogates averaged 60%, these recoveries are inside the acceptance criteria for 50-150% recovery.

Duplicate Results

Duplicate results for slurry leachate samples are presented in Table 21.

For metals analysis, matrix spike analysis was performed in duplicate. Repeatability of the spike recovery was expected within 20% CV. All metals analyzed for this matrix met this criteria.

For volatile analysis, matrix spike analysis was performed in duplicate. All results are within the 50% CV required by the QAPP.

CORE SAMPLES AND CORE LEACHATE SAMPLES

Both core samples and leachates of core samples were analyzed in the lab at same time. QA/QC for these analyses are results will be discussed below.

Blank

Chromium, lead, and zinc were detected in the two of the five samples submitted to the laboratory as extraction blanks. Results are presented in Table 22. Copper was detected in one of nine reagent blanks, lead was detected in five blanks, and zinc was detected in four of nine laboratory

TABLE 21. LAB DUPLICATE (SAMPLES OR ANALYSES) FOR SLURRY LEACHATE SAMPLES

Parameter	Routine Sample ID	Duplicate Sample ID	Routine Value	Duplicate Value	Mean Concentration	Standard Deviation	% CV
metals by ic							
Cadmium	P8-01-021	P8-01-021_dup	93.00000	90.00000	91.50000	2.12132	2.31838
Cadmium	P8-01-021	P8-01-021_dup	91.00000	90.00000	90.50000	0.70711	0.78133
Cadmium	P8-01-021	P8-01-021_dup	92.00000	90.00000	91.00000	1.41421	1.55408
Cadmium	S8-01-018	S8-01-018_dup	90.00000	90.00000	90.00000	0.00000	0.00000
Cadmium	S8-01-045	S8-01-045_dup	95.00000	94.00000	94.50000	0.70711	0.74826
Chromium, total	S8-01-018	S8-01-018_dup	86.00000	86.00000	86.00000	0.00000	0.00000
Chromium, total	S8-01-045	S8-01-045_dup	93.00000	92.00000	92.50000	0.70711	0.76444
Chromium, total	P8-01-021	P8-01-021_dup	108.00000	112.00000	110.00000	2.82843	2.57130
Chromium, total	P8-01-021	P8-01-021_dup	88.00000	90.00000	89.00000	1.41421	1.58900
Copper	P8-01-021	P8-01-021_dup	93.00000	91.00000	92.00000	1.41421	1.53719
Copper	P8-01-021	P8-01-021_dup	86.00000	93.00000	89.50000	4.94975	5.53044
Copper	S8-01-018	S8-01-018_dup	85.00000	84.00000	84.50000	0.70711	0.83681
Copper	S8-01-045	S8-01-045_dup	88.00000	86.00000	87.00000	1.41421	1.62553
Nickel	P8-01-021	P8-01-021_dup	85.00000	85.00000	85.00000	0.00000	0.00000
Nickel	S8-01-045	S8-01-045_dup	96.00000	91.00000	93.50000	3.53553	3.78132
Nickel	S8-01-018	S8-01-018_dup	93.00000	91.00000	92.00000	1.41421	1.53719
Zinc	S8-01-045	S8-01-045_dup	96.00000	95.00000	95.50000	0.70711	0.74043
Zinc	S8-01-018	S8-01-018_dup	90.00000	90.00000	90.00000	0.00000	0.00000
Zinc	P8-01-021	P8-01-021_dup	94.00000	93.00000	93.50000	0.70711	0.75626
Zinc	P8-01-021	P8-01-021_dup	95.00000	87.00000	91.00000	5.65685	6.21632
Volatile Organics by GC/MS							
1,1-Dichloroethylene	S7-11-038	S7-11-038_dup	42.00000	43.00000	42.50000	0.70711	1.66378
1,1-Dichloroethylene	S711035-6	S711035-6_dup	75.00000	75.00000	75.00000	0.00000	0.00000
Benzene	S7-11-038	S7-11-038_dup	84.00000	89.00000	86.50000	3.53553	4.08732
Benzene	S711035-6	S711035-6_dup	113.00000	114.00000	113.50000	0.70711	0.62300
Chlorobenzene	S711035-6	S711035-6_dup	97.00000	100.00000	98.50000	2.12132	2.15362
Chlorobenzene	S7-11-038	S7-11-038_dup	91.00000	97.00000	94.00000	4.24264	4.51345
Toluene	S711035-6	S711035-6_dup	101.00000	106.00000	103.50000	3.53553	3.41597
Toluene	S7-11-038	S7-11-038_dup	138.00000	104.00000	121.00000	24.04163	19.86912

TABLE 21. (Continued)

Parameter	Routine Sample ID	Duplicate Sample ID	Routine Value	Duplicate Value	Mean Concentration	Standard Deviation	% CV
Trichloroethylene	S711035-6	S711035-6_dup	79.00000	80.00000	79.50000	0.70711	0.88944
Trichloroethylene	S7-11-038	S7-11-038_dup	62.00000	65.00000	63.50000	2.12132	3.34066
Semivolatile Organics by GC/MS							
1,4-Dichlorobenzene	P7-10-024	P7-10-024_dup	44.00000	49.00000	46.50000	3.53553	7.60330
1,4-Dichlorobenzene	P7-10-024	P7-10-024_dup	62.00000	58.00000	60.00000	2.82843	4.71405
1,4-Dichlorobenzene	P7-10-024	P7-10-024_dup	61.00000	56.00000	58.50000	3.53553	6.04365
4-Nitrophenol	P7-10-024	P7-10-024_dup	9.00000	10.00000	9.50000	0.70711	7.44323
4-Nitrophenol	P7-10-024	P7-10-024_dup	13.00000	16.00000	14.50000	2.12132	14.62980
4-Nitrophenol	P7-10-024	P7-10-024_dup	20.00000	18.00000	19.00000	1.41421	7.44323
Acenaphthene	P7-10-024	P7-10-024_dup	60.00000	64.00000	62.00000	2.82843	4.56198
Acenaphthene	P7-10-024	P7-10-024_dup	69.00000	70.00000	69.50000	0.70711	1.01742
Acenaphthene	P7-10-024	P7-10-024_dup	62.00000	64.00000	63.00000	1.41421	2.24478
4-chloro-3-methylphenol	P7-10-024	P7-10-024_dup	64.00000	60.00000	62.00000	2.82843	4.56198
4-chloro-3-methylphenol	P7-10-024	P7-10-024_dup	57.00000	66.00000	61.50000	6.36396	10.34790
4-chloro-3-methylphenol	P7-10-024	P7-10-024_dup	56.00000	56.00000	56.00000	0.00000	0.00000
Di-N-Butylphthalate	P7-10-024	P7-10-024_dup	66.00000	67.00000	66.50000	0.70711	1.06332
Di-N-Butylphthalate	P7-10-024	P7-10-024_dup	73.00000	84.00000	78.50000	7.77817	9.90850
Di-N-Butylphthalate	P7-10-024	P7-10-024_dup	80.00000	76.00000	78.00000	2.82843	3.62619
N-Nitrosodi-N-Propylamine	P7-10-024	P7-10-024_dup	66.00000	67.00000	66.50000	0.70711	1.06332
N-Nitrosodi-N-Propylamine	P7-10-024	P7-10-024_dup	52.00000	58.00000	55.00000	4.24264	7.71389
N-Nitrosodi-N-Propylamine	P7-10-024	P7-10-024_dup	60.00000	62.00000	61.00000	1.41421	2.31838
Pentachlorophenol	P7-10-024	P7-10-024_dup	8.00000	38.00000	23.00000	21.21320	92.23132
Pentachlorophenol	P7-10-024	P7-10-024_dup	28.00000	22.00000	25.00000	4.24264	16.97056
Phenol	P7-10-024	P7-10-024_dup	35.00000	41.00000	38.00000	4.24264	11.16484
Phenol	P7-10-024	P7-10-024_dup	44.00000	40.00000	42.00000	2.82843	6.73435
Phenol	P7-10-024	P7-10-024_dup	35.00000	40.00000	37.50000	3.53553	9.42809
Pyrene	P7-10-024	P7-10-024_dup	102.00000	122.00000	112.00000	14.14214	12.62691
Pyrene	P7-10-024	P7-10-024_dup	75.00000	97.00000	86.00000	15.55635	18.08878
Pyrene	P7-10-024	P7-10-024_dup	84.00000	86.00000	85.00000	1.41421	1.66378

TABLE 21. (Continued)

Parameter	Routine Sample ID	Duplicate Sample ID	Routine Value	Duplicate Value	Mean Concentration	Standard Deviation	% CV
EP toxicity							
Cadmium	P7-12-040	P7-12-040_dup	94.00000	93.00000	93.50000	0.70711	0.75626
Chromium, total	P7-12-040	P7-12-040_dup	94.00000	93.00000	93.50000	0.70711	0.75626
Copper	P7-12-040	P7-12-040_dup	101.00000	98.00000	99.50000	2.12132	2.13198
Lead	P7-12-040	P7-12-040_dup	100.00000	100.00000	100.00000	0.00000	0.00000
Nickel	P7-12-040	P7-12-040_dup	94.00000	93.00000	93.50000	0.70711	0.75626
Zinc	P7-12-040	P7-12-040_dup	106.00000	104.00000	105.00000	1.41421	1.34687
graphite furnace							
Lead	S8-01-018	08-01-018_dup	57.00000	52.00000	54.50000	3.53553	6.48722
Lead	P8-01-021	P8-01-021_dup	100.00000	89.00000	94.50000	7.77817	8.23087
Lead	S8-01-045	S8-01-045_dup	98.00000	98.00000	98.00000	0.00000	0.00000
Lead	P8-01-021	P8-01-021_dup	88.00000	96.00000	92.00000	5.65685	6.14875

TABLE 22. SUMMARY OF BLANK RESULTS FOR CORE AND CORE LEACHATE SAMPLES

Method Type	Parameter	Total Number of Blanks	Total Number above Detection Limit	Concentration (ug/L) Range Minimum	-	Maximum
Metals by ICPES						
Extraction Blank						
	Chromium, total	5	2	8.50	-	19.0
	Zinc	5	2	7.50	-	13.5
Reagent						
	Copper	9	1	0.010	-	0.010
	Zinc	9	4	0.0020	-	3.80
Volatile Organics by GC/MS						
Reagent						
	1,1,1-Trichloroethane	10	1	83.0	-	83.0
	Methylene Chloride	10	2	2.00	-	330.0
	Xylene	10	2	0.60	-	660.0
	Acetone	10	2	20.0	-	21.0
	Chloroform	10	1	3.00	-	3.00
	Ethylbenzene	10	2	69.0	-	99.0
	Styrene	10	1	6.00	-	6.00
	Toluene	10	2	110.0	-	130.0
Graphite Furnace						
Field Blank						
	Lead	5	2	1.39	-	4.68
Reagent						
	Lead	9	1	0.15	-	0.15

blanks. Review of the field data shows that low levels of these analytes is not a serious problem.

Eight compounds were detected in the laboratory reagent blank by Method 8240. Methylene chloride, xylene, acetone, ethylbenzene, and toluene were detected in two of the ten laboratory reagent blanks. Styrene, chloroform, and 1,1,1-trichloroethane were detected in one of the ten reagent blanks. Samples with low levels of these analytes should be viewed with suspicion.

There were no PCBs detected in the laboratory reagent blank by Methods 8080 or 680.

Spiked Sample Results

Spiked sample results for core and core leachate samples are presented in Table 23.

Ten samples were spiked for analyses of metals by ICPES. The acceptance criteria is 80-120% recovery of the spiked amount. Recoveries for all analytes was within acceptance criteria, except one sample recovery for nickel, which was below these limits.

Lead was analyzed by graphite furnace. Recovery of matrix spiked samples was expected to be within 80-120% recovery for these samples. Only one analyte in ten spiked samples was below this acceptance criteria.

Eight spiked samples were analyzed by Method 8240 for volatile organic compounds. Two samples were outside the acceptance criteria specified by CLP for toluene recovery. Recovery of the four other spiked analytes in these samples were within acceptance criteria. Results for the other six samples was within the acceptance criteria.

TABLE 23. SUMMARY OF SPIKE RESULTS FOR CORE AND CORE LEACHATE SAMPLES

Method Type	Parameter	Number of Samples	Mean % Recovery	Standard Deviation	Number Below Acceptance Limits	Number Above Acceptance Limits	(Matrix) Acceptance Criteria
metals by ic							
m							
	Cadmium	10	96.9	6.32877	0	0	80.0 - 120.0
	Chromium, total	10	94.9	9.83635	0	0	80.0 - 120.0
	Copper	10	100.4	6.21951	0	0	80.0 - 120.0
	Nickel	10	90.5	8.72394	1	0	80.0 - 120.0
PCBs by gc/ms							
m							
	monochlorobiphenyls PCB	3	78.0	.00000	0	0	50.0 - 150.0
	dichlorobiphenyls PCB	3	84.0	.00000	0	0	50.0 - 150.0
	trichlorobiphenyls PCB	2	86.0	.00000	0	0	50.0 - 150.0
	tetrachlorobiphenyls PCB	2	75.0	.00000	0	0	50.0 - 150.0
	pentachlorobiphenyls PCB	2	80.0	.00000	0	0	50.0 - 150.0
	hexachlorobiphenyls PCB	2	88.0	.00000	0	0	50.0 - 150.0
	heptachlorobiphenyls PCB	2	84.0	.00000	0	0	50.0 - 150.0
	octachlorobiphenyls PCB	2	98.0	.00000	0	0	50.0 - 150.0
	decachlorobiphenyls PCB	2	75.0	.00000	0	0	50.0 - 150.0
s							
	13-C6 4-chlorobiphenyl	8	75.5	3.58569	0	0	50.0 - 150.0
	13-C octachlorobiphenyl	6	86.0	15.51773	0	0	50.0 - 150.0
	13-C12 decachlorobiphenyl	8	44.5	7.80110	6	0	50.0 - 150.0
PCBs by GC							
m							
	Aldrin	1	132.0		0	0	50.0 - 150.0
	Endrin	1	83.0		0	0	50.0 - 150.0
	4,4'DDT	1	111.0		0	0	50.0 - 150.0
s							
	Dibutyl chlorendate	12	207.8	54.92116	0	12	50.0 - 150.0

(Continued)

TABLE 23. (Continued)

Method Type	Parameter	Number of Samples	Mean % Recovery	Standard Deviation	Number Below Acceptance Limits	Number Above Acceptance Limits	(Matrix) Acceptance Criteria
Volatile Organics by GC/MS							
m							
	1,1-dichloroethene	8	81.9	35.94217	0	0	0 - 234.0
	Benzene	8	102.1	7.35697	0	0	37.0 - 151.0
	Chlorobenzene	8	93.4	10.70297	0	0	37.0 - 160.0
	Toluene	8	135.9	49.54489	0	2	47.0 - 150.0
	Trichloroethene	8	123.0	19.83503	0	0	71.0 - 157.0
	d4-dichloroethane	99	99.7	11.16330	0	0	76.0 - 114.0
	d8-toluene	99	100.5	11.66914	0	0	88.0 - 110.0
	5-bromofluorobenzene	99	100.3	8.59302	0	0	86.0 - 115.0
graphite furnace							
m							
	Lead	10	95.4	7.02887	0	10	80.0 - 120.0

The mean percent recovery for each of the three surrogate compounds was 100%. Ninety nine samples were analyzed by Method 8240. Recovery of these compounds is excellent, well within the acceptance criteria specified by CLP.

Recovery of the matrix spike compounds in the spiked sample for PCBs by GC were within the 50-150% recovery specified by the QAPP. However, surrogate recoveries for Method 8080 averaged 208%. PCB results are discussed in Appendix C of the final report.

Duplicate Results

Matrix spike compounds were analyzed in duplicate whenever possible. Results of these analyses are presented in Table 24.

Repeatability of the metals analyses was expected to be within 20% CV. Precision for analysis of the six priority pollutant metals was not only within this range, but were less than 10% CV.

Precision for analysis of volatile organic compounds by Method 8240 were also good, based on matrix spike duplicate recoveries. These results were within 10% CV for all analyses but one (11% CV). This is well within the QAPP specified accuracy objectives for this analyses.

SEMI-VOLATILE ORGANIC COMPOUND ANALYSES

Semi-volatile compounds were analyzed by Method 8270. Samples were analyzed separately for base/neutral extract fractions and acid extract fractions. QC results for these analyses are discussed below.

Blank Results

Results for laboratory analyses are presented in Table 25. Of the the thirteen laboratory blanks analyzed for acid extractable semi-volatile

TABLE 24. LAB DUPLICATE (SAMPLES OR ANALYSES) FOR CORE AND CORE LEACHATE SAMPLES

Parameter	Routine Sample ID	Duplicate Sample ID	Routine Value	Duplicate Value	Mean Concentration	Standard Deviation	% CV
metals by ic							
Cadmium	S7-12-088	S7-12-088_dup	89.00000	87.00000	88.00000	1.41421	1.60706
Cadmium	P8-02-049	P8-02-049_dup	93.80000	107.30000	100.55000	9.54594	9.49373
Cadmium	P8-02-027	P8-02-027_dup	95.80000	96.10000	95.95000	0.21213	0.22109
Cadmium	P8-02-003	P8-02-003_dup	100.00000	101.00000	100.50000	0.70711	0.70359
Cadmium	P8-02-003	P8-02-003_dup	100.00000	101.00000	100.50000	0.70711	0.70359
Chromium, total	P8-02-049	P8-02-049_dup	95.40000	91.30000	93.35000	2.89914	3.10566
Chromium, total	S7-12-088	S7-12-088_dup	82.00000	80.00000	81.00000	1.41421	1.74594
Chromium, total	P8-02-003	P8-02-003_dup	104.00000	104.00000	104.00000	0.00000	0.00000
Chromium, total	P8-02-027	P8-02-027_dup	90.20000	89.70000	89.95000	0.35355	0.39306
Chromium, total	P8-02-003	P8-02-003_dup	104.00000	108.00000	106.00000	2.82843	2.66833
Copper	P8-02-003	P8-02-003_dup	107.00000	110.00000	108.50000	2.12132	1.95513
Copper	P8-02-049	P8-02-049_dup	98.50000	90.00000	94.25000	6.01041	6.37709
Copper	P8-02-003	P8-02-003_dup	100.00000	108.00000	104.00000	5.65685	5.43928
Copper	P8-02-027	P8-02-027_dup	99.30000	99.50000	99.40000	0.14142	0.14228
Copper	S7-12-088	S7-12-088_dup	95.00000	97.00000	96.00000	1.41421	1.47314
Nickel	P8-02-003	P8-02-003_dup	94.00000	103.00000	98.50000	6.36396	6.46087
Nickel	P8-02-027	P8-02-027_dup	86.00000	84.80000	85.40000	0.84853	0.99359
Nickel	S7-12-088	S7-12-088_dup	86.00000	83.00000	84.50000	2.12132	2.51044
Nickel	P8-02-049	P8-02-049_dup	85.00000	79.80000	82.40000	3.67696	4.46232
Nickel	P8-02-003	P8-02-003_dup	102.00000	101.00000	101.50000	0.70711	0.69666
Zinc	S7-12-088	S7-12-088_dup	90.00000	88.00000	89.00000	1.41421	1.58900
Zinc	P8-02-003	P8-02-003_dup	93.00000	105.00000	99.00000	8.48528	8.57099
Zinc	P8-02-027	P8-02-027_dup	96.10000	96.40000	96.25000	0.21213	0.22040
Zinc	P8-02-049	P8-02-049_dup	96.10000	90.40000	93.25000	4.03051	4.32226
Zinc	P8-02-003	P8-02-003_dup	103.00000	103.00000	103.00000	0.00000	0.00000
graphite furnace							
Lead	S7-12-088	S7-12-088_dup	107.00000	105.00000	106.00000	1.41421	1.33416
Lead	P8-02-003	P8-02-003_dup	87.00000	91.00000	89.00000	2.82843	3.17801
Lead	P8-02-003	P8-02-003_dup	86.00000	96.00000	91.00000	7.07107	7.77040

TABLE 24. (Continued)

Parameter	Routine Sample ID	Duplicate Sample ID	Routine Value	Duplicate Value	Mean Concentration	Standard Deviation	% CV
Lead	P8-02-027	P8-02-027_dup	97.50000	90.90000	94.20000	4.66690	4.95425
Lead	P8-02-049	P8-02-049_dup	99.00000	94.10000	96.55000	3.46482	3.58863
Volatile Organics by GC/MS							
1,1-Dichloroethane	P7-12-004	P7-12-004_dup	86.00000	84.00000	85.00000	1.41421	1.66378
1,1-Dichloroethane	P7-12-004	P7-12-004_dup	89.00000	81.00000	85.00000	5.65685	6.65512
Benzene	P7-12-004	P7-12-004_dup	112.00000	102.00000	107.00000	7.07107	6.60847
Benzene	P7-12-004	P7-12-004_dup	104.00000	101.00000	102.50000	2.12132	2.06958
Chlorobenzene	P7-12-004	P7-12-004_dup	104.00000	98.00000	101.00000	4.24264	4.20063
Chlorobenzene	P7-12-004	P7-12-004_dup	104.00000	101.00000	102.50000	2.12132	2.06958
Toluene	P7-12-004	P7-12-004_dup	225.00000	190.00000	207.50000	24.74874	11.92710
Toluene	P7-12-004	P7-12-004_dup	107.00000	120.00000	113.50000	9.19239	8.09902
Trichloroethylene	P7-12-004	P7-12-004_dup	105.00000	99.00000	102.00000	4.24264	4.15945
Trichloroethylene	P7-12-004	P7-12-004_dup	112.00000	113.00000	112.50000	0.70711	0.62854

TABLE 25. SUMMARY OF BLANK RESULTS FOR SEMI-VOLATILE ORGANIC ANALYSES

Method Type	Parameter	Total Number of Blanks	Total Number above Detection Limit	Concentration (ug/L) Range		
				Minimum	-	Maximum
8270 Acid Extractables						
Reagent						
	bis(2-ethylhexyl)phthalate	13	2	12.0	-	15000
	diethyl phthalate	13	2	3900	-	4500
	n-nitrosodiphenylamine	12	2	7400	-	7700
	di-n-butyl phthalate	13	2	14.0	-	5200

compounds, only four analytes were detected in the blanks. Bis(2-ethylhexyl)phthalate, diethyl phthalate, n-nitrosodiphenylamine, and di-n-butyl phthalate were detected in two of the blanks. Phthalates are common laboratory contaminants, and are allowed by CLP to be present in blanks at levels up to five times the detection limit. Low levels of these compounds in the field samples may be caused by laboratory contamination, and should be viewed with suspicion. There were no analytes detected in the base/neutral extractable portion of the laboratory blanks.

Spiked Sample Analysis

Results for spiked samples are presented in Table 26.

Five acid and six base/neutral extractable compounds were spiked into fourteen samples for analysis by Method 8270. Results were acceptable for all analytes in all samples. Surrogate spike recoveries of the six compounds were acceptable for the 113 samples analyzed by Method 8270.

TABLE 26. SUMMARY OF SPIKE RESULTS FOR SEMI-VOLATILE ORGANIC ANALYSES

Method Type	Parameter	Number of Samples	Mean % Recovery	Standard Deviation	Number Below Acceptance Limits	Number Above Acceptance Limits	(Matrix) Acceptance Criteria
8270	Acid Extractables						
m							
	4-nitrophenol	14	37.6	22.21474	0	0	0 - 132
	acenaphthene	14	69.4	25.24865	0	0	47 - 145
	di-n-butyl phthalate	14	69.0	18.31351	0	0	1 - 118
	pentachlorophenol	14	69.1	49.20048	0	0	14 - 176
8270	Base Extractables						
m							
	1,2,4-trichlorobenzene	14	57.9	63.61720	0	7	44 - 142
	1,4-dichlorobenzene	14	64.7	24.13242	0	0	0 - 124
	2-chlorophenol	14	46.1	43.97177	0	0	23 - 134
	4-chloro-3-methylphenol	14	82.6	24.82466	0	0	22 - 147
	n-nitroso-di-n-propylamine	14	46.6	19.59045	0	0	0 - 230
	naphthalene	14	0	.00000	0	0	0 - 0
	nitrobenzene	14	0	.00000	0	0	0 - 0
	phenol	14	53.6	16 75486	0	0	5 - 112
	Terphenyl-d14	113	108.2	40.90161	0	0	33 - 141
	Nitrobenzene-d5	113	75.7	30.83054	0	0	35 - 114
	2-Fluorobiphenyl	113	82.3	14.09520	0	0	43 - 116
	Phenol-d6	113	76.5	19.86882	0	0	10 - 94
	2-Fluorophenol	113	81.5	26.22537	0	0	21 - 100
	2,4,6-Tribromophenol	113	83.5	27.89269	0	0	10 - 123

APPENDIX D

PERFORMANCE AUDIT RESULTS

RADIAN
CORPORATION

AUDIT REPORT
14 March 1988

272-008-06-00

TO: Distribution
FROM: Kenneth R. Cox
PROJECT: Hazcon
SUBJECT: October 1987 Performance Audit Sample Results

1.0 INTRODUCTION

On October 22, 1987, performance audit samples were prepared and submitted to Megan Day for distribution to the laboratories conducting analyses for the Hazcon project. Samples simulating leachates of solid grab samples were submitted to Radian's Perimeter Park Gas Chromatography (PPKGC) Laboratory, Perimeter Park Gas Chromatography/Mass Spectroscopy (PPKGCMS) Laboratory, Sacramento Inorganic (SPCINOR) Laboratory, and Austin Water Quality (APCWQL) Laboratory. All of the samples were analyzed. Results for the audit samples were received between December 10, 1987 and March 8, 1988. This audit additionally qualified for consideration as part of the 1988 Chemistry Division Internal Audit Program. Results for the audit samples are assumed to be representative of the quality of the data for similar samples analyzed during the same time period. Analytical performance was assessed for the following method:

- Purgeable Organics in water samples by EPA Method 8240 analyzed at PPKGCMS;

- Semi-volatile base/neutral and acid extractable organics in water samples by EPA Method 8270 analyzed at PPKGCMS;

- Polychlorinated biphenyls in water samples by EPA Method 8080 analyzed at PPKGC;

- Metals in water samples by EPA Method 200.7 (ICPES) analyzed at SPCINOR;
- Metals in water samples by various EPA methods using AA analyzed at SPCINOR; and
- Oil and Grease in water samples by EPA Method 413.2 analyzed at AUSWQL.

2.0 RECOMMENDATIONS FOR CORRECTIVE ACTION

No formal recommendations for corrective action are required at this time. The following potential problems raised by the audit sample results are recommended for further investigation by the laboratory managers.

- PPKGCMS:

Investigate and confirm reported analytical results outside the accuracy objectives for tetrachloroethene in sample 1087-17 (fraction 01 of work order S7-10-162) and toluene in sample 1087-18 (fraction 02 of work order S7-10-162) analyzed by EPA Method 8240.

Investigate and confirm false positive results reported for acetone in the water matrix samples 1087-17, 1087-18 and 1087-19 (fractions 01, 02, and 03 of work order S7-10-162), 2-butanone in sample 1087-17 (fraction 01 of work order S7-10-162), and benzene and toluene in sample 1087-19 (fraction 03 of work order S7-10-162) analyzed by EPA Method 8240.

Investigate and confirm reported analytical results outside the accuracy objectives for nitrobenzene, naphthalene, and bis(2-ethylhexyl)phthalate in sample 1087-05 (fraction 01 of work order P7-10-034) analyzed by EPA Method 8270.

Investigate and confirm false positive results reported for 2-nitrophenol, 2,4-dichlorophenol and 4-chloro-3-methylphenol, di-n-octylphthalate, di-n-butylphthalate and phenanthrene in the water matrix sample 1087-05 (fraction 01 of work order P7-10-034), and bis(2-Ethylhexyl)-phthalate and di-n-butylphthalate in water matrix sample 1087-07 (fraction 03 of work order P7-10-034) analyzed by EPA Method 8270.

Investigate and confirm false negative results reported for 2,4-dimethylphenol and anthracene in the water matrix sample 1087-05 (fraction 01 of work order P7-10-034) analyzed by EPA Method 8270.

Investigate and confirm reported analytical results outside the accuracy objectives for the surrogate spike recovery of d6-phenol in sample 1087-05 (fraction 01 of work order P7-10-034) analyzed by EPA Method 8270.

Investigate and confirm false positive results reported for nickel in the water matrix sample 1087-14 (fraction 13 of work order P7-10-034), and zinc in the water matrix samples 1087-14, 1087-15, and 1087-16 (fractions 13, 14, and 15 of work order P7-10-034) analyzed by EPA Method 200.7.

Investigate and confirm false negative results reported for barium in the water matrix samples 1087-14 and 1087-15 (fractions 13 and 14 of work order P7-10-034) analyzed by EPA Method 200.7.

Investigate and confirm reported analytical results outside the accuracy objectives for arsenic and selenium in the water matrix samples 1087-14 and 1087-15 (fraction 13 and 14 of work order P7-10-034), and mercury and lead in water matrix sample 1087-14 (fraction 13 of work order P7-10-034) analyzed by EPA atomic absorption methods.

Investigate and confirm false positive results reported for mercury and selenium in the water matrix sample 1087-16 (fraction 15 of work order P7-10-034) analyzed by EPA atomic absorption methods.

3.0 DISCUSSION

The audit, or performance evaluation (PE), samples used for the October 1987 laboratory performance audit were submitted as sets of three samples. The sample sets consisted of two samples spiked at levels representative of expected Hazcon leachates and a matrix blank of Milli-Q water. Audit samples were prepared by spiking standards prepared from NBS SRM's, reagent grade salts, and neat materials into laboratory pure matrices. The matrix for the water samples was Milli-Q water.

Details of the potential problems raised by the analytical results for these audit samples are summarized below:

- Perimeter Park Gas Chromatography /Mass Spectroscopy (PPKGCMS) Laboratory:
  - -- Recovery outside the accuracy objectives (lower than expected) for tetrachloroethene the water matrix sample 1087-17 and toluene in the water matrix sample 1087-18 analyzed by EPA Method 8240. Tetrachloroethene and toluene were present in the samples at >8.5 and >10 times the reported detection limits respectively.
  - -- False positive results were reported for acetone in the water matrix samples 1087-17, 1087-18, and 1087-19, 2-butanone in the water matrix sample 1087-17, and benzene and toluene in the water matrix sample 1087-19 analyzed by EPA Method 8240. Analytical data for field samples may indicate the same compound as present. There is a possibility that the results are due to contribution from an outside source.

- Recovery outside the accuracy objectives (higher than expected) for nitrobenzene, naphthalane, and bis(2-Ethylhexyl)phthalate in the water matrix sample 1087-05 analyzed by EPA Method 8270. Nitrobenzene, naphthalene, and bis(2-Ethylhexyl)phthalate were present in the sample at 1.9, 1.3 and 0.8 times the reported detection limits respectively.

- False positive results were reported for 2-nitrophenol, 2,4-dichlorophenol and 4-chloro-3-methylphenol, di-n-octylphthalate, di-n-butylphthalate and phenanthrene in the water matrix sample 1087-05 and bis(2-Ethylhexyl)-phthalate and di-n-butylphthalate in water matrix sample 1087-07 analyzed by EPA Method 8270. Analytical data for field samples may indicate the same compound as present. There is a possibility that the results are due to contribution from an outside source.

- False negative results were reported for 2,4-dimethylphenol and anthracene in the water matrix sample 1087-05 by EPA Method 8270. 2,4-Dimethylphenol and anthracene were were spiked at 1.0 and 1.5 times their respective reported detection limits. The possibility exists for these analytes to be present in field samples at these levels but not be detected.

- Recovery outside the accuracy objectives (higher than expected) for the surrogate spike recovery of d6-phenol in sample 1087-05 analyzed by EPA Method 8270.

- Sacramento Production Chemistry Inorganic (SPCINOR) Laboratory:

  -- False positive results were reported for nickel in the water matrix sample 1087-14 and zinc the water matrix samples 1087-14, 1087-15, and 1087-16 analyzed by EPA Method 200.7. Analytical data for field samples may indicate the same compound as present. There is a possibility that the results are due to contribution from an outside source.

  -- False negative results were reported for barium in the water matrix samples 1087-14 and 1087-15 analyzed by EPA Method 200.7. Barium was spiked at >183, 110, and 0 times the method detection limit of barium in these samples respectively. The possibility exists for these analytes to be present in field samples at these levels but not be detected. Estimate the percentage of results for Hazcon samples that may be similarly affected.

  -- Recovery outside the accuracy objectives for arsenic and selenium in the water matrix samples 1087-14 and 1087-15 and mercury and lead in water matrix sample 1087-14 analyzed by various EPA atomic absorption methods. Mercury, arsenic, lead, and selenium were spiked at levels 8.8, 11.5, 26.5, and 1.98 times their reported detection limits in sample 1087-14. Arsenic and selenium were spiked at levels 10 and 2 times their reported detection limits in sample 1087-15.

-- False positive results reported for mercury and selenium in the water matrix sample 1087-16 by EPA atomic absorption methods. Analytical data for field samples may indicate the same compound as present. There is a possibility that the results are due to contribution from an outside source.

3.1 Purgeable Organics in Liquid Samples by EPA Method 8240

Performance evaluation samples simulating liquid leachates were prepared and submitted to PPKGCMS for analysis by EPA Method 8240. Three samples containing six of the Hazcon analytes of interest, spiked at concentrations from >2.9 to 50 times the reported method detection limits of the analyte, were submitted. All three samples were analyzed. The matrix of the spiking solution was Milli-Q water that had been boiled and purged with helium. The results of the audit are presented in Table 1.

Overall Method Evaluation Score

Category	Possible	Deductions	Score
Qualitative	40 points	0 MI, 2 FP, 3 SFP	29 points
Quantitative	40 points	2 MQ, 0 FN	32 points
Reporting	20 points		20 points
Number of Target Compounds = 10		Total	81/100 points

Results for Sample 1087-17 indicate correct identification of all six of the target analytes. All of the target analytes were quantitated within the accuracy objectives as specified in Method 8240. Acetone and 2-butanone were reported as a false positives in this sample. Results for sample 1087-18 indicate correct identification of all four of the target analytes. All of the analytes were quantitated within the accuracy objectives as stated in Method 8240. Acetone was also reported as a false positive in this sample. Sample 1087-19 was a matrix blank. False positives were reported for acetone, toluene, and benzene in this sample. Analytical data for field samples may indicate the same compounds as present. There is a possibility that the results are due to contribution from an outside source.

TABLE 1A. OCTOBER 1987 PERFORMANCE AUDIT RESULTS FOR GC/MS ANALYSES FOR PURGEABLE ORGANICS IN WATER SAMPLES - EPA METHOD 8240 - GC/MS (PPK - MORRISVILLE, NC)

Parameter	Expected Method Detection Limit[a] (ug/L)	EPA Performance Specification[b] (% Recovery)	1087-17			1087-18			1087-19 Matrix Blank
			Audit Value (ug/L)	Reported Value (ug/L)	Sample Recovery[c] (%)	Audit Value (ug/L)	Reported Value (ug/L)	Sample Recovery[c] (%)	Reported Value (ug/L)
Ethylbenzene	7.2	37-162	55	30	55	139	59	42	ND
Chlorobenzene	6.0	37-160	104	43	41	–[d]	ND	–[e]	ND
Total Xylenes	4.6	NS	28	11	39	230	110	48	ND
Toluene	6.0	47-162	32	19	59	142	62	44[f]	2.2[g,h]
Benzene	4.4	37-151	13	7.5	58	49	28	57	1.9[g,h]
Tetrachloroethene	4.1	64-148	35	21	60[f]	–[d]	ND	–[e]	ND
2-butanone	25	NS	–[d]	5.3[g,h]	FP	–[d]	ND	–[e]	ND
Acetone	7.5	NS	–[d]	17[g,h]	FP	–[d]	6.8[g,h]	FP	6.5[g,h]
Surrogate Spike Recoveries[i]									
d_4-1,2-Dichloroethane	NS	77-120	50	NR	90	50	NR	94	92
d_8-Toluene	NS	86-119	50	NR	100	50	NR	95	97
p-Bromofluorobenzene	NS	85-121	50	NR	108	50	NR	105	102

[a] Laboratory reported detection limit.
[b] Range of expected percent recovery for target compound spiked into reagent water (Reference EPA Method 624).

[c] Sample Recovery (%) = $\frac{\text{Reported Value}}{\text{Audit Value}}$ x 100.

[d] Not contained in audit sample.
[e] Cannot be calculated or calculation not meaningful.
[f] Measured value outside expected range of recovery (underlined for emphasis).
[g] Present in laboratory reagent blank.
[h] Estimated value less than laboratory detection limit.
[i] For surrogate spikes expected range of recovery and audit value (spike level) taken from EPA CLP protocol.

ND - Not Detected.
FP - False Positive; analyte not contained in audit sample.
NS - Not Specified.
NR - Not Reported; laboratory routinely reports only the % recovery for spikes.

3.2 Semi-Volatile Base/Neutral Extractable Organics by EPA Method 8270

Performance evaluation samples simulating liquid leachates were prepared and submitted to PPKGCMS for analysis by EPA Method 8270. Three samples containing 19 of the Hazcon analytes of interest, spiked at concentrations from less than to 2 times the reported practical quantitation limits of the analyte, were submitted. All three samples were analyzed. The matrix of the spiking solution was Milli-Q water. The results of the audit are presented in Table 2.

Overall Method Evaluation Score

Category	Possible	Deductions	Score
Qualitative	40 points	1 MI, 1 FP, 2 SFP	34 points
Quantitative	40 points	3 MQ, 1 FN	32 points
Reporting	20 points		20 points
Number of Target Compounds = 19		Total	86/100 points

Results for Sample 1087-05 indicate correct identification of 18 of the target analytes. Three of the target analytes were quantitated outside the accuracy objectives as specified in Method 8270. Di-n-octylphthalate, di-n-butylphthalate, and phenanthrene were reported as false positives in this sample. Results for sample 1087-06 indicate correct identification of none of the target analytes. All of the analytes were quantitated outside the accuracy objectives as stated in Method 8270. It was learned from Megan Day that the sample had been dropped during analysis. The surrogate spike recoveries were not reported because they were not detected. For these reasons this sample will not be scored. Sample 1087-07 was a matrix blank. A false positive was reported for di-n-butylphthalate in this sample. Analytical data for field samples may indicate the same compounds as present. There is a possibility that the results are due to contribution from an outside source.

TABLE 2. OCTOBER 1987 PERFORMANCE AUDIT RESULTS FOR SEMI-VOLATILE BASE/NEUTRAL EXTRACTABLE ORGANICS IN WATER SAMPLES - EPA METHOD 8270 - GC/MS (PPK - MORRISVILLE, NC)

Parameter	Method Detection Limit[a] (ug/L)	EPA Performance Specification[b] (% Recovery)	1087-05 Audit Value (ug/L)	1087-05 Reported Value (ug/L)	1087-05 Sample Recovery[c] (%)	1087-06 Audit Value (ug/L)	1087-06 Reported Value (ug/L)	1087-06 Sample Recovery[c] (%)	1087-07 Matrix Blank Reported Value (ug/L)
1,4-Dichlorobenzene	10	20-124	13	8	62	5	ND	FN	ND
Bis(2-chloroisopropyl)ether	10	36-166	10	7	70	4	ND	FN	ND
Hexachloroethane	10	40-113	15	8	53	6	ND	FN	ND
Nitrobenzene	10	35-180	19	54	284[d]	8	ND	FN	ND
Naphthalene	10	21-133	13	30	230[d]	5	ND	FN	ND
Dimethyl Phthalate	10	D-112	20	4	20	8	ND	FN	ND
Acenaphthene	10	47-145	10	5	50	4	ND	FN	ND
Fluorene	10	59-121	13	10	77	5	ND	FN	ND
4-Chlorophenyl phenyl ether	10	25-158	19	18	95	8	ND	FN	ND
4-Bromophenyl phenyl ether	10	53-127	19	18	95	8	ND	FN	ND
Anthracene	10	27-133	10	ND	FN	4	ND	FN	ND
Fluoranthene	10	26-137	15	9	60	6	ND	FN	ND
Butyl Benzyl Phthalate	10	D-152	13	3	23	5	ND	FN	ND
Chrysene	10	17-168	10	12	120	4	ND	FN	ND
Bis(2-Ethylhexyl)phthalate	10	8-158	8	19	238[d]	3	ND	FN	10
Benzo(b)Fluoranthene	10	24-159	10	10	100	4	ND	FN	ND
Benzo(a)Pyrene	10	17-163	11	9	82	4	ND	FN	ND
Dibenzo(a,h)Antrhacene	10	D-227	10	13	130	4	ND	FN	ND
Benzo(g,h,i)Perylene	10	D-219	15	16	107	6	ND	FN	ND
Di-n-octylphthalate	10	4-146	-e	10	FP	-e	ND	-f	ND
Di-n-butylphthalate	10	1-118	-e	8	FP	-e	ND	-f	11
Phenanthrene	10	54-120	-e	7	FP	-e	ND	-f	ND

(Continued)

TABLE 2. (Cont'd) OCTOBER 1987 PERFORMANCE AUDIT RESULTS FOR SEMI-VOLATILE BASE/NEUTRAL EXTRACTABLE ORGANICS IN WATER SAMPLES - EPA METHOD 8270 - GC/MS (PPK - MORRISVILLE, NC)

Parameter	Method Detection Limit[a] (ug/L)	EPA Performance Specification[b] (% Recovery)	1087-05			1087-06			1087-07
			Audit Value (ug/L)	Reported Value (ug/L)	Sample Recovery[c] (%)	Audit Value (ug/L)	Reported Value (ug/L)	Sample Recovery[c] (%)	Matrix Blank Reported Value (ug/L)
Surrogate Spike Recoveries[g]									
Nitrobenzene-d5	NS	23-120	50	NR	147	50	NR	NR	77
2-Fluorobiphenyl	NS	43-116	50	NR	91	50	NR	NR	76
P-Terphenyl-d14	NS	33-141	50	NR	82	50	NR	NR	130

[a] Method Detection Limit as published in EPA Method 8270; These are Ground Water Practical Quantitation Limits.

[b] Expected range of recovery for target compound spiked into reagent water (reference EPA Method 625).

[c] $\text{Sample Recovery (\%)} = \frac{\text{Reported Value}}{\text{Audit Value}} \times 100.$

[d] Measured value outside the acceptable range of recovery (underlined for emphasis).

[e] Not contained in audit sample.

[f] Cannot be calculated or calculation not meaningful.

[g] For surrogate spikes, expected range of recovery and audit value (spiking level) taken from EPA CLP protocol.

D - Detected.
NS - Not Specified.
NR - Not Reported.

ND - Not Detected.
FP - False Positive; Reported as present, but not contained in the audit sample.
FN - False Negative; Contained in the audit sample, but not identified.

3.3 Semi-Volatile Acid Extractable Organics by EPA Method 8270

Performance evaluation samples simulating liquid leachates were prepared and submitted to PPKGCMS for analysis by EPA Method 8270. Three samples containing ten of the Hazcon analytes of interest, spiked at concentrations from 1.5 to 3 times the reported practical quantitation limits of the analyte, were submitted. All three samples were analyzed. The matrix of the spiking solution was Milli-Q water. The results of the audit are presented in Table 3.

Overall Method Evaluation Score

Category	Possible	Deductions	Score
Qualitative	40 points	1 MI, 0 FP, 0 SFP	36 points
Quantitative	40 points	3 MQ, 1 FN	24 points
Reporting	20 points		20 points
Number of Target Compounds = 10		Total	80/100 points

Results for Sample 1087-05 indicate correct identification of all nine of the target analytes. Six of the target analytes were quantitated within the accuracy objectives as specified in Method 8270. Results for sample 1087-06 indicate correct identification of none of the target analytes. All of the analytes were quantitated outside the accuracy objectives as stated in Method 8270. It was learned from Megan Day that the sample had been dropped during analysis. The surrogate spike recoveries were not reported because they were not detected. For these reasons this sample will not be scored. Sample 1087-07 was a matrix blank. No analytes were detected.

TABLE 3. OCTOBER 1987 PERFORMANCE AUDIT RESULTS FOR GC/MS ANALYSES OF SEMI-VOLATILE ACID EXTRACTABLE ORGANICS IN WATER SAMPLES - EPA METHOD 8270 - GC/MS (PPK - MORRISVILLE, NC)

Parameter	Method Detection Limit[a] (ug/L)	EPA Performance Specification[b] (% Recovery)	1087-05 Audit Value (ug/L)	1087-05 Reported Value (ug/L)	1087-05 Sample Recovery[c] (%)	1087-06 Audit Value (ug/L)	1087-06 Reported Value (ug/L)	1087-06 Sample Recovery[c] (%)	1087-07 Matrix Blank Reported Value (ug/L)
2-Chlorophenol	10	23-134	30	24	80	15	ND	FN	ND
2-Nitrophenol	10	29-182	25	60	$\underline{240}^{d}$	13	ND	FN	ND
Phenol	10	5-112	25	20	80	13	ND	FN	ND
2,4-Dimethylphenol	10	32-119	15	ND	FN	8	ND	FN	ND
2,4-Dichlorophenol	10	39-135	25	55	$\underline{220}^{d}$	13	ND	FN	ND
2,4,6-Trichlorophenol	10	37-144	25	14	56	13	ND	FN	ND
4-Chloro-3-methylphenol	20	22-147	23	52	$\underline{226}^{d}$	12	ND	FN	ND
2-Methyl-4,6-dinitrophenol	50	D-181	75	42	56	38	ND	FN	ND
Pentachlorophenol	50	14-176	38	14	37	19	ND	FN	ND
4-Nitrophenol	50	D-132	25	10	40	13	ND	FN	ND
Surrogate Spike Recoveries[e]									
2-Fluorophenol	NS	21-100	50	NR	91	50	NR	NR	66
d_6-Phenol	NS	10-94	50	NR	$\underline{101}^{d}$	50	NR	NR	65
2,4,6-Tribromophenol	NS	10-123	50	NR	119	50	NR	NR	73

[a] Detection limit as published in EPA Method 8270; These are Practical Quantitation Limits for ground water samples.

[b] Expected range of percent recovery for target compound spiked into reagent water. (Reference EPA Method 625).

[c] Sample Recovery (%) = $\frac{\text{Reported Value}}{\text{Audit Value}} \times 100$.

[d] Measured value outside the acceptable range of recovery (underlined for emphasis).

[e] For surrogate spikes expected range of recovery and audit value (spiking level) taken from EPA CLP protocol.

D - Detected; result must be greater than zero.
ND - Not Detected.
FN - False Negative.
NS - Not Specified.
NR - Not Reported; laboratory routinely reports only the % recovery for spikes.

3.4 PCBs in Liquid Samples by EPA Method 8080

Performance evaluation samples simulating liquid leachates were prepared and submitted to PPKGC for analysis by EPA Method 8080. Three samples containing one of the Hazcon analytes of interest, spiked at concentrations from 210 to 360 times the reported method detection limit of the analyte, were submitted. All three samples were analyzed. The matrix of the spiking solution was Milli-Q water. The results of the audit are presented in Table 4.

Overall Method Evaluation Score

Category	Possible	Deductions	Score
Qualitative	40 points	0 MI, 0 FP, 0 SFP	40 points
Quantitative	40 points	0 MQ, 0 FN	40 points
Reporting	20 points		20 points
Number of Target Compounds = 1			Total 100/100 points

Results for Sample 0188-08 indicate correct identification of the target analyte. The target analyte was quantitated within the accuracy objectives. Results for sample 0188-09 indicate correct identification of the target analyte. The analyte was quantitated within the accuracy objectives. Sample 1087-10 was a matrix blank. The analyte was not detected in this sample.

TABLE 4. OCTOBER 1987 PERFORMANCE AUDIT RESULTS FOR POLYCHLORINATED BIPHENYLS IN WATER SAMPLES - EPA METHOD 8080 - GC/ECD (PPK - MORRISVILLE, NC)

Parameter	Method Detection Limit[a] (ug/L)	EPA Performance Specification[b] (% Recovery)	1087-08			1087-09			1087-10 Matrix Blank
			Audit Value (ug/L)	Reported Value (ug/L)	Sample Recovery[c] (%)	Audit Value (ug/L)	Reported Value (ug/L)	Sample Recovery[c] (%)	Reported Value (ug/L)
Arochlor No. 1254	NS	39-135	7.2	3.7	51	4.2	2.4	57	ND

[a] Detection limit not specified in EPA Method 8080.

[b] Expected range of recovery based on interlaboratory testing.

[c] Sample Recovery (%) = $\frac{\text{Reported Value}}{\text{Audit Value}}$ x 100.

NS = Not Specified.

3.5 Metals in Liquid Samples by EPA Method 200.7

Performance evaluation samples simulating liquid leachates were prepared and submitted to SPCINOR for analysis by EPA Method 200.7. Three samples containing four of the Hazcon analytes of interest, spiked at concentrations from >3.7 to 184 times the method detection limits of the analyte, were submitted. All three samples were analyzed. The matrix of the spiking solution was Milli-Q water. The results of the audit are presented in Table 5.

Overall Method Evaluation Score

Category	Possible	Deductions	Score
Qualitative	40 points	2 MI, 2 FP, 1 SFP	19 points
Quantitative	40 points	0 MQ, 2 FN	30 points
Reporting	20 points		20 points
Number of Target Compounds = 8		Total	69/100 points

Results for Sample 1087-14 indicate correct identification of three of the four target analytes. Three of the target analytes were quantitated within the accuracy objectives as specified in Method 200.7. The recovery for barium was not reported. Zinc and nickel were reported as false positives in this sample. Results for sample 1087-15 indicate correct identification of three of the four target analytes. Three of the analytes were quantitated within the accuracy objectives as stated in Method 200.7. Zinc was also reported as a false positive in this sample. Sample 1087-19 was a matrix blank. A false positive was reported for zinc. Analytical data for field samples may indicate the same compounds as present. There is a possibility that the results are due to contribution from an outside source.

TABLE 5. OCTOBER 1987 PERFORMANCE AUDIT RESULTS FOR METALS IN WATER SAMPLES - METHOD 200.7 - ICPES (SPCINOR - SACRAMENTO, CA)

Parameter	Method Detection Limit[a] (ug/L)	Expected Range of Recovery[b] (%)	1087-14 Audit Value (ug/L)	1087-14 Reported Value (ug/L)	1087-14 Sample Recovery[c] (%)	1087-15 Audit Value (ug/L)	1087-15 Reported Value (ug/L)	1087-15 Sample Recovery[c] (%)	1087-16 Matrix Blank Reported Value[d] (ug/L)
Cadmium	4	71-119	65	60	92	64	60	94	<4
Chromium	7	84-116	98	90	92	68	60	88	<7
Silver	7	79-119	26	20	77	42	40	95	<7
Barium	2	83-121	367	NR	FN	220	NR	FN	NR
Nickel	15	NS	-d	30	FP	-d	ND	-e	<15
Zinc	2	NS	-d	10	FP	e	4	FP	3
Antimony	32	NS	-d	ND	-e	-d	ND	-e	<34
Beryllium	0.3	NS	-d	ND	-e	-d	ND	-e	<1
Copper	6	NS	-d	ND	-e	-d	ND	-e	<6

[a] Detection limits as published in EPA Method 200.7.

[b] Expected range of recovery, based on interlaboratory testing.

[c] Sample Recovery (%) = $\frac{\text{Reported Value}}{\text{Audit Value}}$ x 100.

[d] Element not present in audit sample or certified concentration of element not available.

[e] Cannot be calculated or calculation not meaningful.

NA - Not analyzed for by this method.
FP - False positive.
ND - Not detected.
NR - Not Reported.
FN - False Negative.

3.6 Metals in Liquid Samples by EPA Method AA

Performance evaluation samples simulating liquid leachates were prepared and submitted to SPCINOR for analysis by EPA AA Methods. Three samples containing four of the Hazcon analytes of interest, spiked at concentrations from >1.9 to 26.5 times the method detection limits of the analyte, were submitted. All three samples were analyzed. The matrix of the spiking solution was Milli-Q water. The results of the audit are presented in Table 6.

Overall Method Evaluation Score

Category	Possible	Deductions	Score
Qualitative	40 points	0 MI, 0 FP, 2 SFP	38 points
Quantitative	40 points	6 MQ, 0 FN	10 points
Reporting	20 points		20 points
Number of Target Compounds = 8		Total	68/100 points

Results for Sample 1087-14 indicate correct identification of all four target analytes. None of the target analytes were quantitated within the accuracy objectives. Results for sample 1087-15 indicate correct identification of all four target analytes. Two of the analytes were quantitated within the accuracy objectives. Sample 1087-19 was a matrix blank. False positives were reported for mercury and lead. Analytical data for field samples may indicate the same compounds as present. There is a possibility that the results are due to contribution from an outside source.

TABLE 6. OCTOBER 1987 PERFORMANCE AUDIT RESULTS FOR METALS IN WATER SAMPLES - AA (SPCINOR - SACRAMENTO, CA)

Parameter	Method Detection Limit[a] (ug/L)	EPA Method Number	Expected Range of Recovery[b] (%)	1087-14			1087-15			1087-16 Matrix Blank
				Audit Value (ug/L)	Reported Value (ug/L)	Sample Recovery[c] (%)	Audit Value (ug/L)	Reported Value (ug/L)	Sample Recovery[c] (%)	Reported Value[d] (ug/L)
Mercury	0.2	245.1	74-119	4.4	2.5	57[e]	2	1.7	85	0.7
Arsenic	3	206.2	77-119	46	30	65[e]	40	30	75[e]	<4
Lead	1	239.2	82-117	53	40	75[e]	34	30	88	5
Selenium	2	270.2	62-124	7.9	20	253[e]	8.0	20	250[e]	<4

[a] From EPA Methods for Chemical Analysis of Water and Wastes, June 1982.

[b] Expected range of recovery based on interlaboratory testing.

[c] $\text{Sample Recovery (\%)} = \frac{\text{Reported Value}}{\text{Audit Value}} \times 100.$

[d] Numbers in parentheses are laboratory detection limits, reported if significantly different from the expected method detection limit.

[e] Recovery outside the expected range of recovery (underlined for emphasis).

3.7 Oil & Grease in Liquid Samples by EPA Method 413.2

Performance evaluation samples simulating liquid leachates were prepared and submitted to AUSWQL for analysis by EPA Method 413.2. Three samples containing one of the Hazcon analytes of interest, spiked at concentrations from 14.3 to 28.5 times the reported method detection limits of the analyte, were submitted. All three samples were analyzed. The matrix of the spiking solution was Milli-Q water. The results of the audit are presented in Table 7.

Overall Method Evaluation Score

Category	Possible	Deductions	Score
Qualitative	40 points	0 MI, 0 FP, 0 SFP	40 points
Quantitative	40 points	0 MQ, 0 FN	40 points
Reporting	20 points		20 points
Number of Target Compounds = 1			Total 100/100 points

Results for Sample 1087-08 indicate correct identification of the target analyte. The target analyte was quantitated within the accuracy objectives as specified in Method 8270. Results for sample 1087-09 indicate correct identification of the target analyte. The analyte was quantitated within the accuracy objectives as stated in Method 8270. Sample 1087-10 was a matrix blank. The analyte was not detected in this sample.

APPENDIX A

DATA TABLES

TABLE A-1. PERMEABILITIES AND BULK DENSITIES OF MINIMALLY DISTURBED SOILS COLLECTED IN SHELBY TUBES FOR THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT

Sample Source	X-Coordinate	Y-Coordinate	Test Status	Constant Head Permeability (cm/sec)	Bulk Density (g/mL as collected)
Background Soil	NA[a]	NA	Test	6.0×10^{-3}	1.63[b]
Drum Storage DSA	1	7	Test	6.1×10^{-1}	1.18[c]
	6	7	Test	5.2×10^{-1}	1.36
	3	3	Partial	--	1.14[c]
Lagoon North LAN	0	3	Test	2.7×10^{-3}	1.29
	1	1	Test	9.6×10^{-4}	1.47
	5	8	Partial	--	1.44
Filter Sludge FSA	10	9	Test	Impermeable[d]	1.48
	3	4	Test	Impermeable[d]	1.47
	8	5	Partial	--	1.84
Landfarm LFA	3	1	Test	1.9×10^{-1}[e]	1.66
	8	3	Test	2.0×10^{-2}	1.76
	6	9	Partial	--	1.62
Processing Facility PFA	1	11	Test	8.9×10^{-2}	1.81
	7	12	Test	6.6×10^{-2}	1.81
	9	10	Partial	--	1.57
Lagoon South LAS	3	6	Test	5.3×10^{-6}	1.79
	9	8	Partial	--	1.56
	9	4	Test	2.4×10^{-5}	1.56
	10	4	Test	1.4×10^{-2}[e]	1.43
	2	10	Test	9.1×10^{-2}[e]	1.60

[a] Not applicable.

[b] Compacted bulk density on background soil taken from dumped soil.

[c] Recalculated based on dimensions measured after permeability tests were run. Bulk densities calculated from original dimensions were 1.01 for the DSA sample with coordinates 1,7 and 1.10 for the DSA sample with coordinates 3,3.

[d] Materials were "impermeable" as measured by the constant head method.

[e] Channeling suspected.

TABLE A-2. GRAIN SIZE, pH, AND MOISTURE FOR COMPOSITE UNTREATED SOILS FROM THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT

Sample Source	Composite Designation	Composite Part Designation	Test Status	Grain[a] Size 50% finer than (mm)	Soil pH (pH units)	Moisture (%[b])
Background Soil	1	1	Test	0.18	6.43	15.3
Background Soil 2	1	1	Duplicate	--	--	16.0
Drum Storage	1	1	Test	0.075	6.46	11.4
DSA	1	1	Duplicate	0.043	--	12.2
	1	2	Test	0.045	6.30	12.2
	2	1	Partial	--	6.48	11.8
Lagoon North	1	1	Test	9.11	3.76	17.6
LAN	1	2	Test	0.10	3.61	17.5
	2	1	Test	0.082	3.74	17.9
	2	2	Partial	--	3.63	17.6
Filter Sludge	1	1	Test	Cohesive[c]	2.40	28.8
FSA	1	2	Test	Cohesive[c]	2.37	23.1
	1	2	Duplicate	--	--	23.7
	2	1	Partial	--	2.90	23.1
Landfarm	1	1	Test	0.075	4.58	15.9
LFA	1	1	Duplicate	0.032	4.52	--
	1	2	Test	0.080	4.59	17.7
	2	1	Partial	--	4.58	16.6
Processing	1	1	Test	0.55[d]	6.85	6.6
Facility	1	2	Test	0.69[d]	7.10	6.4
PFA	2	1	Partial	--	7.05	6.7
	2	1	Duplicate	--	7.03	--
Lagoon South	1	1	Test	0.10	4.15	12.8
LAS	1	2	Partial	--	4.08	13.2
	2	1	Test	0.09	4.03	11.9
	2	1	Duplicate	--	4.21	--
	4	1	Test	0.07	4.11	11.3
	5	1	Test	0.09	4.10	10.4

[a] Fifty percent of the particles by weight had effective spherical diameters smaller than the value shown.

[b] Calculated from weight loss at 110°C; moisture = $\frac{\text{(wet weight - dry weight) x 100}}{\text{(wet weight)}}$.

[c] Cohesive material and grain size could not be measured.

[d] Forty percent finer than, because 50% was not reached. See graphs in Appendix B.

TABLE A-3. POLYCHLORINATED BIPHENYLS (PCBs) CONCENTRATIONS IN COMPOSITE UNTREATED SOILS FROM THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT MEASURED BY GAS CHROMATOGRAPHY METHOD 8080

Sample Source	Composite Designation	Composite Part Designation	Test Status	PCBs by 8080 Arochlor 1248 in Soil[a] (micrograms/gram)[b]	PCBs by 8080 Arochlor 1260 in Soil[a] (micrograms/gram)[b]
Background Soil	1	1	Test	<0.2	<0.2
Drum Storage	1	1	Test	<0.2	1.1
DSA	1	2	Test	<0.2	1.3
	1	3	Reserve		
	2	1	Partial		
Lagoon North	1	1	Test	<0.02	43
LAN	1	2	Test	<0.02	51
	1	3	Reserve		
	2	1	Test	<0.02	59
	2	2	Partial		
Filter Sludge	1	1	Test		
FSA	1	2	Test	<0.02	36
	1	3	Reserve	<0.02	44
	2	1	Partial		
Landfarm	1	1	Test	<0.02	10
LFA	1	2	Test	<0.02	10
	1	3	Reserve		
	2	1	Partial		

(Continued)

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[a] Surrogate recoveries indicate that concentrations may be valid only to within a factor of 2.

[b] Based on soil as collected.

TABLE A-3. (Continued)

Sample Source	Composite Designation	Composite Part Designation	Test Status	PCBs by 8080 Arochlor 1248 in Soil^a (micrograms/gram)^b	PCBs by 8080 Arochlor 1260 in Soil^a (micrograms/gram)^b
Processing Facility PFA	1	1	Test	19	14
	1	2	Test	19	15
	1	3	Reserve		
	2	1	Partial		
Lagoon South LAS	1	1	Test	40	31
	1	2	Partial		
	2	1	Test	28	19
	3	1	Reserve		
	4	1	Test	32	23
	5	1	Test	<0.02	37
Method Blank				<0.02	<0.02

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[a] Surrogate recoveries indicate that concentrations may be valid only to within a factor of 2.

[b] Based on soil as collected.

TABLE A-4. VOLATILE ORGANIC COMPOUND CONCENTRATIONS IN COMPOSITE UNTREATED SOILS FROM THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT

Sample Source	Composite Designation	Composite Part Designation	Test Status	(All Concentrations in µg/L) 1	2	3	4	5	6	7	8	9	10	11	12
Background Soil	1	1	Test	<6	<6	<6	<6	6[a]	<9	<2	<6	<6	<3	<2	<2
Drum Storage DSA	1	1	Test	<6	<6	<6	<6	8[a]	9[a]	<2	<6	<5	<3	<2	<2
	1	2	Test	<6	<6	<6	<6	5[a]	<8	<1	<6	<5	<3	<2	<2
	1	3	Reserve	<6	<6	<6	<6	5[a]	<8	<2	<6	<5	<3	<2	<2
Lagoon North LAN	1	1	Test	<6	<6	<6	<6	43[a]	1600[a]	18	26	<6	5	27	2
	1	2	Test	<6	<6	<6	<6	27[a]	930[a]	8	13	<6	<3	16	<2
	2	1	Test	<6	<6	<6	<6	33	1200[a]	8	10	<6	<3	15	<2
Filter Sludge FSA	1	1	Test	<5100	<5100	<5100	<5100	<2900	<7700	<1700	<5100	<4800	<2900	<1600	<1600
	2	1	Substitute	<3100	<3100	<3100	<3100	<1800	<4700	<1100	<3100	<2900	<1800	<1000	<1000
Landfarm LFA	1	1	Test	<6	<6	<6	<6	23[a]	11[a]	<2	8	<5	<3	<2	<2
	1	2	Test	<6	<6	<6	<6	5[a]	12[a]	<2	<6	<6	<3	<2	<2
Processing Facility PFA	1	1	Test	<50	<50	<50	<50	52[a]	<80	<20	<50	<50	<30	58	<20
	1	2	Test	<50	<50	<50	<50	34[a]	<80	<20	<50	<50	<30	47	<20
Lagoon South LAS	1	1	Test	<30	<30	<30	<30	64[a]	43[a]	<10	41	<30	55	100	<10
	2	1	Test	<30	<30	<30	<30	<20	<40	<10	<30	<30	<20	<10	<10
	4	1	Test	<30	<30	<30	<30	19[a]	<40	<10	<30	<30	<20	<10	<10
	5	1	Test	<700	<700	<700	<700	<390	<1000	<240	<700	<650	<390	<220	<220

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[a] Detected in Reagent Blank, but background subtraction not performed.

(Continued)

TABLE A-4. (Continued)

Sample Source	Composite Designation	Composite Part Designation	Test Status	(All Concentrations in µg/L) 13	14	15	16	17	18	19	20	21	22	23	24
Background Soil	1	1	Test	<3	<30	<5	<3	<8	<3	<7	<6	<2	<4	<6	<5
Drum Storage DSA	1	1	Test	<3	<30	<4	<3	<8	<3	<7	<6	<2	<4	<6	8^a
	1	2	Test	<3	<30	<4	<3	<8	<3	<7	<6	<2	<4	<6	8^a
	1	3	Reserve	<3	<30	<4	<3	<8	<3	<7	<6	<2	<4	<6	5^a
Lagoon North LAN	1	1	Test	43	<30	84	<3	<8	<3	<7	<6	200	<4	<6	51^a
	1	2	Test	<3	58	31	<3	<8	<3	<7	<6	93	<4	<6	24^a
	2	1	Test	<3	<30	30	<3	<8	<3	<7	<6	86	<4	<6	20^a
Filter Sludge FSA	1	1	Test	<2900	<26000	<3900	<2900	<7100	<2300	<6200	<5100	21000	<3200	<5100	5000
	2	1	Substitute	<1800	<16000	<2400	<1800	<4300	<1400	<3800	<3100	6700	<1900	<3100	<2800
Landfarm LFA	1	1	Test	<3	<30	<4	<3	<8	<3	<7	<6	<2	<8	<6	10^a
	1	2	Test	<3	<30	<5	<3	<8	<3	<7	<6	<2	<4	<6	10^a
Processing Facility PFA	1	1	Test	<30	<260	<40	<30	<70	<20	<60	<50	<20	<30	<50	<50
	1	2	Test	<30	<270	<40	<30	<70	<20	<60	<50	<20	<30	<50	<50
Lagoon South LAS	1	1	Test	<20	<140	1300	<20	<40	<10	<30	<30	1000	<20	<30	53^a
	2	1	Test	<20	<140	<20	<20	<40	<10	<30	<30	29	<20	<30	<20
	4	1	Test	<20	<140	24	<20	<40	<10	<30	<30	170	<30	<50	<50
	5	1	Test	<390	<3500	<530	<390	<960	<310	<830	<700	1100	<430	<700	<610

[a] Detected in Reagent Blank; background subtraction not performed.

(Continued)

TABLE A-4. (Continued)

Sample Source	Composite Designation	Composite Part Designation	Test Status	(All Concentrations in μg/L)											
				25	26	27	28	29	30	31	32	33	34	35	36
Background Soil	1	1	Test	<6	<6	<6	<40	<60	<5	<8	<7	<7	<9	<4	<6
Drum Storage DSA	1	1	Test	<6	<6	<5	<40	<50	<5	<8	<7	<7	<8	<3	<5
	1	2	Test	<6	<6	<5	<40	<50	<5	<8	<7	<7	<8	<3	<5
	1	3	Reserve	<6	<6	<5	<40	<50	<5	<8	<7	<7	<8	<3	<5
Lagoon North LAN	1	1	Test	<6	<6	<6	1600[a]	550[a]	280	<8	2000[a]	<7	280	<4	1500
	1	2	Test	<6	<6	<6	530[a]	180[a]	100	24	520[a]	<7	120	<4	660
	2	1	Test	<6	<6	<6	<40	200	110	<8	460	<7	130	<4	740
Filter Sludge FSA	1	1	Test	<5100	<5100	<4800	<37000	<47000	9300	<7100	40000	<6200	25000	<3100	140000
	2	1	Substitute	<3100	<3100	<2900	<23000	<29000	2900	<4300	12000	<3800	1000	<1900	43000
Landfarm LFA	1	1	Test	<6	<6	<5	<40	<50	<5	<8	<7	<7	<8	<4	<5
	1	2	Test	<6	<6	<6	<40	<60	<5	<8	<7	<7	<9	<4	<6
Processing Facility PFA	1	1	Test	<50	<50	<50	<370	<480	110	<70	<60	<60	<80	<30	320
	1	2	Test	<50	<50	<50	<380	<490	88	<70	<60	<60	<80	<30	320
Lagoon South LAS	1	1	Test	<30	<30	<30	<200	<260	3700	<40	810	<30	320	<30	3200
	2	1	Test	<30	<30	<30	<200	<260	200	<40	68	<30	<40	<20	250
	4	1	Test	<30	<30	<30	<200	<260	350	<40	300	<30	170	<20	1600
	5	1	Test	<700	<700	<640	<5000	<6400	1700	<960	<830	<830	1100	<420	9900

[a] Detected in Reagent Blank; background subtraction not performed.

(Continued)

TABLE A-4. (Continued)

Key to VOCs

1. chloromethane
2. bromomethane
3. vinyl chloride
4. chloroethane
5. methylene chloride
6. acetone
7. carbon disulfide
8. trichlorofluoromethane
9. 1,1-dichloroethene
10. 1,1-dichloroethane
11. trans-1,2-dichloroethene
12. chloroform
13. 1,2-dichloroethane
14. 2-butanone
15. 1,1,1-trichloroethane
16. carbon tetrachloride
17. vinyl acetate
18. bromodichloromethane
19. 1,2-dichloropropane
20. cis-1,3-dichloropropene
21. trichloroethene
22. dibromochloromethane
23. 1,1,2-trichloroethane
24. benzene
25. trans-1,3-dichloropropene
26. 2-chloroethylvinyl ether
27. bromoform
28. 2-hexanone
29. 4-methyl-2-pentanone
30. tetrachloroethene
31. 1,1,2,2-tetrachloroethane
32. toluene
33. chlorobenzene
34. ethylbenzene
35. styrene
36. total xylenes

TABLE A-5. BASE-NEUTRAL-ACID (BNA) SEMI-VOLATILE ORGANIC COMPOUND CONCENTRATIONS IN COMPOSITE UNTREATED SOILS FROM THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT

Sample Source	Composite Designation	Composite Part Designation	Test Status	(All Concentrations in μg/kg) 1	2[a]	3	4	5	6	7	8	9	10
Detection Limit				520	1020	5400	330	1400	1800	700	800	620	620
Background Soil	1	1	Test	2300	6060	<5400	3100	<1400	<1800	<700	<800	<620	<620
Drum Storage	1	1	Test	1900	14000	9000	3400	<1400	<1800	<700	<800	<620	<620
DSA	1	2	Test	21000	16000	<5400	<330	<1400	<1800	<700	<800	<620	<620
Lagoon North	1	1	Test	1600	18000	<5400	12000	6700	<1800	<700	<800	<620	<620
LAN	1	2	Test	10000	15000	<5400	17000	8800	13000	4700	1300	3400	6300
	2	1	Test	1800	12000	<5400	4600	<1400	<1800	<700	<800	<620	<620
Filter Sludge	1	2	Test	7000	<1020	<5400	<330	62000	<1800	<700	<800	<620	<620
FSA	1	3	Reserve	1400	17000	<5400	20000	56000	40000	<700	<800	<260	<620
Landfarm	1	1	Test	10000	12000	<5400	17000	<1400	<1800	<700	<800	<620	<620
LFA	1	2	Test	23000	51000	<5400	17000	<1400	<1800	<700	<800	<620	<620
Processing	1	1	Test	1600	15000	<5400	14000	<1400	<1800	2400	<800	<620	<620
Facility PFA	1	2	Test	3500	13000	12000	<330	<1400	<1800	<700	<800	<620	<620
Lagoon South	1	1	Test	2100	8110	<5400	22300	<1400	<1800	2700	<800	<620	<620
LAS	2	1	Test	1900	8400	<5400	3200	<1400	<1800	<700	<800	<620	<620
	4	1	Test	1600	7900	<5400	25000	<1400	<1800	11000	<800	<620	<620
	5	1	Test	28000	7900	<5400	40000	<1400	<1800	<700	<800	<620	<620

[a] Laboratory contaminant.

(Continued)

TABLE A-5. (Continued)

Sample Source	Composite Designation	Composite Part Designation	Test Status	(All Concentrations in µg/kg)									
				11	12	13	14	15	16	17	18	19	20
Detection Limit				600	3000	680	1100	700	1600	600	900	800	1900
Background Soil	1	1	Test	<600	<3000	<680	<1100	<700	<1600	<600	<900	<800	<1900
Drum Storage	1	1	Test	<600	<3000	<680	<1100	<700	<1600	<600	<900	<800	<1900
DSA	1	2	Test	<600	<3000	<680	<1100	<700	<1600	<600	<900	<800	<1900
Lagoon North	1	1	Test	<600	<3000	<680	<1100	<700	<1600	<600	<900	<800	<1900
LAN	1	2	Test	3400	5100	8500	8200	8800	6800	6900	6600	7500	12000
	2	1	Test	<600	<3000	<680	<1100	<700	<1600	<600	<900	<800	<1900
Filter Sludge	1	2	Test	<6000	<3000	<680	<1100	<700	<1600	<600	<900	<800	<1900
FSA	1	3	Reserve	21000	<3000	<680	<1100	<700	<1600	<600	<900	<800	<1900
Landfarm	1	1	Test	<600	<3000	<680	<1100	<700	<1600	<600	<900	<800	<1900
LFA	1	2	Test	<600	<3000	<680	<1100	<700	<1600	<600	<900	<800	<1900
Processing	1	1	Test	<600	<3000	<680	<1100	<700	<1600	<600	<900	<800	<1900
Facility PFA	1	2	Test	<600	<3000	<680	<1100	<700	<1600	<600	<900	<800	<1900
Lagoon South	1	1	Test	<600	<3000	<680	<1100	<700	<1600	<600	<900	<800	<1900
LAS	2	1	Test	<600	<3000	<680	<1100	<700	<1600	8300	<900	<800	<1900
	4	1	Test	<600	<3000	<680	<1100	<700	<1600	<600	<900	<800	<1900
	5	1	Test	15000	<3000	<680	<1100	<700	<1600	<600	<900	<800	<1900

[a] Laboratory contaminant.

(Continued)

TABLE A-5. (Continued)

Sample Source	Composite Designation	Composite Part Designation	Test Status	21	22	23	24	25	26	27	28	29	30	31
				(All Concentrations in μg/kg)										
Detection Limit				900	2100	1400	2300	1700	1400	800	520	1700	1000	1500
Background Soil	1	1	Test	<900	<2100	<1400	<2300	<1700	<1400	<800	<520	<1700	<1000	<1500
Drum Storage DSA	1	1	Test	<900	<2100	<1400	<2300	<1700	<1400	<800	<520	<1700	<1000	<1500
	1	2	Test	<900	<2100	<1400	<2300	<1700	<1400	<800	<520	<1700	<1000	<1500
Lagoon North LAN	1	1	Test	<900	<2100	<1400	<2300	<1700	<1400	<800	7000	<1700	<1000	<1500
	1	2	Test	7400	9400	5800	8500	6200	2900	2600	<520	<1700	<1000	<1500
	2	1	Test	<900	<2100	<1400	<2300	<1700	<1400	<800	<520	<1700	<1000	<1500
Filter Sludge FSA	1	2	Test	<900	<2100	<1400	<2300	<1700	<1400	<800	130000	430000	100000	<1500
	1	3	Reserve	<900	<2100	<1400	<2300	<1700	<1400	<800	100000	39000	84000	23000
Landfarm LFA	1	1	Test	<900	<2100	<1400	<2300	<1700	<1400	<800	<520	<1700	<1000	<1500
	1	2	Test	<900	<2100	<1400	<2300	<1700	<1400	<800	6400	<1700	<1000	<1500
Processing Facility PFA	1	1	Test	<900	<2100	<1400	<2300	<1700	<1400	<800	6200	<1700	<1000	<1500
	1	2	Test	<900	<2100	<1400	<2300	<1700	<1400	<800	9200	<1700	<1000	<1500
Lagoon South LAS	1	1	Test	<900	<2100	<1400	<2300	<1700	<1400	<800	<520	<1700	<1000	<1500
	2	1	Test	<900	<2100	<1400	<2300	<1700	<1400	<800	<520	<1700	<1000	<1500
	4	1	Test	<900	<2100	<1400	<2300	<1700	<1400	<800	7800	<1700	<1000	<1500
	5	1	Test	<900	<2100	<1400	<2300	<1700	<1400	<800	15000	<1700	<1000	<1500

[a] Laboratory contaminant.

TABLE A-5. (Continued)

Key to BNAs
1. Di n-butyl phthalate
2. diphenyl amine (N-nitrosodiphenylamine)
3. pentachlorophenol
4. bis(2-ethylhexly phthalate)
5. 4-methylphenol
6. 2,4-dimethylphenol
7. diethylphthlate
8. fluorene
9. anthracene
10. fluoranthene
11. phenanthrene
12. pronamide
13. benzo(a)anthracene
14. butyl benzyl phthalate
15. chrysene
16 p-dimethylaminoazobenzene
17. pyrene
18. benzo(b)fluoranthene
19. benzo(k)fluoranthene
20. benzo(g,h,i)perylene
21. benzo(a)pyrene
22. dibenz(a,h)anthracene
23. 7,12-dimethylbenz(a)anthracene
24. indeno(1,2,3-cd)pyrene
25. 3-methylchloranthrene
26. dibenz(a,j)acridine
27. dimethylphthalate
28. naphthalene
29. 2-methylphenol
30. phenol
31. 1,2-dichlorobenzene

TABLE A-5. (Continued)

BNA Compounds Not Detected			
Compound	Detection Limit	Compound	Detection Limit
acenaphthene	10	aniline	660
acenaphthylene	10	benzyl alcohol	1300
1-chloronaphthalene	10	bis(2-chloroethyl)ether	660
2-chloronaphthalene	10	bis(2-chloroisopropyl)ether	660
4-chlorophenyl phenyl ether	10	2-chlorophenol	660
dibenzofuran	10	1,3-dichlorobenzene	660
2,4-dinitrophenol	10	1,4-dichlorobenzene	660
2,4-dinitrotoluene	50	ethyl methanesulfonate	660
2,6-dinitrotoluene	10	hexachloroethane	660
hexachlorocyclopentadiene	10	methyl methanesulfonate	660
1-naphthylamine	10	n-nitrosodimethylamine	660
2-naphthylamine	10	n-nitroso-di-n-propylamine	660
2-nitroaniline	50	2-picoline	660
3-nitroaniline	50	acetophenone	660
4-nitroaniline	50	benzoic acid	660
4-nitrophenol	50	bis(2-chloroethoxy)methane	660
pentachlorobenzene	10	4-chloroaniline	1300
1,2,4,5-tetrachlorobenzene	10	4-chloro-3-methylphenol	1300
2,3,4,6-tetrachlorophenol	10	2,4-dichlorophenol	660
2,4,6-trichlorophenol	10	2,6-dichlorophenol	660
2,4,5-trichlorophenol	10	a,a-dimethyl-phenethylamine	660
4-aminobiphenyl	10	hexachlorobutadiene	660
4-bromophenyl phenyl ether	10	isophorone	660
4,6-dinitro-2-methylphenol	50	2-methylnaphthalene	660
diphenylamine	660	nitrobenzene	660
1,2-diphenylhydrazine	10	2-nitrophenol	660
hexachlorobenzene	10	n-nitroso-di-n-butylamine	660
pentachloronitrobenzene	10	n-nitrosopiperidine	660
phenacetin	10	1,2,4-trichlorobenzene	660
benzidine	10	di-n-octylphthalate	660
3,3'-dichlorobenzidine	20		

TABLE A-6. PRIORITY POLLUTANT METALS CONCENTRATIONS IN COMPOSITE UNTREATED SOILS FROM THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT

Sample Source	Composite Designation	Composite Part Designation	Test Status	(All concentrations in mg/kg) Ag	As	Be	Cd	Cr	Cu	Hg	Ni	Pb	Sb	Se	Tl	Zn
Background Soil	1	1	Test	0.93	<0.8	0.29	0.4	78	79	<0.25	37	120	<3	<0.4	<0.4	57
Drum Storage DSA	1	1	Test	<0.7	6.3	1.0	0.7	21	73	<0.25	22	2900	<3	<7	<0.4	300
	1	2	Test	<0.7	6.3	1.1	0.88	26	75	0.45	23	3300	<3	<7	<0.4	330
	2	1	Partial									3500				
Lagoon North LAN	1	1	Test	0.72	3.6	0.29	2.5	19	34	<0.25	5.7	9000	<3	0.5	<0.4	150
	1	2	Test	<0.7	1.6	0.25	2.4	18	35	<0.25	5.4	9500	<3	<0.4	<0.4	150
	2	1	Test	0.8	3.2	0.3	2	20	33	<0.25	8	9500	<3	0.5	<0.4	140
	2	2	Partial									8000				
Filter Sludge FSA	1	1	Test	1.1	3.6	0.2	6.8	37	170	<0.25	8.1	21000	<3	<0.4	<0.4	830
	1	2	Test	1.1	3.9	0.42	5.3	24	86	<0.25	7.8	19000	<3	<0.4	<0.4	480
	1	3	Test	1.1	3.9	0.42	5.3	24	86	<0.25	7.8	19000	<3	<0.4	<0.4	480
	2	1	Partial	1.1	3.6	0.2	6.8	37	170	<0.25	8.1	21000	<3	<0.4	<0.4	830
	2	2	Partial									33000				
Landfarm LFA	1	1	Test	<0.7	4.4	1.2	3.7	47	92	<0.25	22	13000	<3	<7	<0.4	750
	1	2	Test	<0.7	3.6	1.0	4.0	45	88	<0.25	22	13000	<3	<8	<0.4	720
	2	1	Partial									15000				
	2	2	Partial													
Processing Facility PFA	1	1	Test	3.8	10	1.4	5.5	94	440	0.85	45	3400	<3	<8	<0.4	1500
	1	2	Test	3.9	10	1.4	5.5	97	440	0.5	47	3400	<3	<7	<0.4	1700
	2	1	Partial									17000				
Lagoon South LAS	1	1	Test	0.87	6	0.67	3.3	58	130	0.68	19	16000	5.2	<0.4	<0.4	610
	1	2	Partial									13000				
	3	1	Substitute	0.98	6	0.67	3.6	67	140	0.45	16	15000	8.8	<0.4	<0.4	580
	4	1	Test	1.1	6	0.73	3.6	80	140	0.43	17	14000	8.3	<0.4	<0.4	560
	5	1	Test	1.1	6.6	0.76	3.4	77	140	0.45	18	14000	5.8	<0.4	<0.4	550
	5	1	Duplicate	1.2	6.3	0.72	3.9	85	150	0.31	17	17000	9.3	<0.4	<0.4	590

TABLE A-7. OIL AND GREASE AND TOTAL ORGANIC CARBON CONCENTRATIONS IN COMPOSITE UNTREATED SOILS FROM THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT

Sample Source	Composite Designation	Composite Part Designation	Test Status	TOC in Soil (%)	Oil & Grease in Soil (mg/kg)
Background Soil	1	1	Test	0.3[a]	2600
Background Soil	1	1	Duplicate	<0.1	--
Background Soil	2	1	Test	<0.1	--
Drum Storage	1	1	Test	4.6	10000
DSA	1	2	Test	--	13000
	2	1	Partial	5.1	6500
Lagoon North	1	1	Test		170000
LAN	1	2	Test	20	170000
	2	1	Test	24	180000
	2	2	Partial	25	140000
Filter Sludge	1	1	Test	32	270000
FSA	1	2	Test	23	250000
	2	1	Partial	--	240000
Landfarm	1	1	Test	9.6	50000
LFA	1	2	Test	8.2	39000
	2	1	Partial	--	39000
Processing	1	1	Test	7.0	43000
Facility	1	2	Test	8.0	46000
PFA	2	1	Partial	--	45000
Lagoon South	1	1	Test	11	82000
LAS		2	Partial	--	83000
	2	1	Test	24	86000
	2	1	Duplicate	--	84000
	4	1	Test	11	63000
	5	1	Test	11	71000

[a] Value less than five times the detection limit.

TABLE A-8. POLYCHLORINATED BIPHENYLS (PCBs) CONCENTRATIONS IN TCLP EXTRACTS OF COMPOSITE UNTREATED SOILS FROM THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT ESTIMATED BY GAS CHROMATOGRAPHY METHOD 8080

Sample Source	Composite Designation	Composite Part Designation	Test Status	PCBs by 8080
Background Soil	1	1	Test	NP[a]
Background Soil 2	1	1	Test	NP
Drum Storage	1	1	Test	NP
DSA	1	2	Test	NP
	1	3	Reserve	
	2	1	Partial	
Lagoon North	1	1	Test	680 HB[b]
LAN	1	2	Test	680 HB
	1	3	Reserve	
	2	1	Test	680 HB
	2	2	Partial	
Filter Sludge	1	1	Test	
FSA	1	2	Test	
	1	3	Reserve	B 680[c]
	2	1	Partial	B 680
Landfarm	1	1	Test	NP
LFA	1	2	Test	NP
	1	3	Reserve	
	2	1	Partial	
Processing	1	1	Test	680 LA[d]
Facility	1	2	Test	680 HA[e]
PFA	1	3	Reserve	
	2	1	Partial	
Lagoon South	1	1	Test	B 680
	1	2	Partial	
	2	1	Test	
	3	1	Reserve	680 LA
	4	1	Test	680 LA
	5	1	Test	680 LA
	5	1	Duplicate	680 LA

[a] No discernible peaks.
[b] Candidate for 680 test; high level, Group B.
[c] Peaks detected, but below 680 method detection limit.
[d] Candidate for 680 test; low level, Group A.
[e] Candidate for 680 test; high level, Group A.

TABLE A-9. POLYCHLORINATED BIPHENYLS (PCBs) CONCENTRATIONS IN TCLP EXTRACTS OF COMPOSITE UNTREATED SOILS COLLECTED FROM THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT ESTIMATED BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY METHOD 680

Sample Source	Composite Designation	Composite Part Designation	Test Status	Chlorobiphenyls (All Concentrations in μg/L)									
				Mono	Di	Tri	Tetra	Penta	Hexa	Hepta	Octa	Nona	Deca
Drum Storage DSA	1	1	Test	NA[a]	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1	2	Test	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1	3	Reserve	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2	1	Partial	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lagoon North LAN	1	1	Test	<0.05	<0.07	<0.07	<0.12	<0.10	<0.12	<0.18	<0.35	<0.30	<0.33
	1	2	Test	<0.05	<0.07	<0.07	<0.12	<0.10	<0.12	<0.18	<0.35	<0.30	<0.33
	1	3	Reserve	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2	1	Test	<0.05	<0.07	<0.07	<0.12	<0.10	<0.12	<0.18	<0.35	<0.30	<0.33
	2	2	Partial	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Filter Sludge FSA	1	1	Test	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1	2	Test	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1	3	Reserve	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2	1	Partial	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Landfarm LFA	1	1	Test	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1	2	Test	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1	3	Reserve	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2	1	Partial	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Processing Facility PFA	1	1	Test	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1	2	Test	<0.05	<0.07	<0.07	<0.12	<0.10	<0.12	<0.18	<0.35	<0.30	<0.33
	1	3	Reserve	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2	1	Partial	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lagoon South LAS	1	1	Test	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1	2	Partial	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2	1	Test	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	3	1	Reserve	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4	1	Test	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	5	1	Test	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	5	1	Duplicate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

[a] NA = Not analyzed.

TABLE A-10. VOLATILE ORGANIC COMPOUND CONCENTRATIONS IN TCLP EXTRACTS OF COMPOSITE UNTREATED SOILS FROM THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT

Sample Source	Composite Designation	Composite Part Designation	Test Status	(All Concentrations in µg/L) 1	2	3	4	5	6	7	8	9	10	11	12
Background Soil	1	1	Test	<5	<5	<5	<5	<3	18^a	2.4	<5	<5	<3	<2	<2
Background Soil 2	1	1	Substitute	<5	<5	<5	<5	<3	15^a	2.1	<5	<5	<3	<2	<2
Drum Storage	1	1	Test	<50	<50	<50	<50	<30	<80	<20	<50	<50	<30	<20	<20
DSA	1	2	Test	<50	<50	<50	<50	<30	<80	<20	<50	<50	<30	<20	<20
Lagoon North	1	1	Test	<5	<5	<5	<5	8.3	62	<2	<5	<5	<3	<2	<2
LAN	1	2	Test	<5	<5	<5	<5	14	400^a	<2	<5	<5	<3	<2	<2
	2	1	Test	<5	<5	<5	<5	8.3	110^a	<2	<5	<5	<3	<2	<2
Filter Sludge	1	3	Substitute	<5	<5	<5	40	22	170^a	2.7	<5	<5	<3	<2	4.8
FSA	2	1	Substitute	<30	<30	<30	150	50	680^a	12	<30	<20	<10	<8	<8
Landfarm	1	1	Test	<250	<250	<250	<250	220	<380	<85	<250	<240	<140	<80	<80
LFA	1	2	Test	<100	<100	<100	<100	<60	<150	<34	<100	<90	<60	<30	<30
Processing Facility	1	1	Test	<50	<50	<50	<50	<30	<80	<20	<50	<50	<30	<20	<20
PFA	1	2	Test	<200	<200	<200	<200	<110	<300	<70	<200	<190	<110	<60	<60
Lagoon South	1	1	Test	<5	<5	<5	<5	4	55^a	<2	<5	<5	<3	<2	<2
LAS	3	1	Test	<5	<5	<5	<5	5.9	47^a	<2	<5	<5	<3	<2	<2
	4	1	Test	<5	<5	<5	<5	3.4	29^a	<2	<5	<5	<3	<2	<2
	5	1	Test	<5	<5	<5	<5	4.8	39^a	<2	<5	<5	<3	<2	<2
	5	1	Reserve	<5	<5	<5	<5	4.9	32^a	<2	<5	<5	<3	<2	<2

[a] Detected in Reagent Blank; background subtraction not performed.

(Continued)

TABLE A-10. (Continued)

Sample Source	Composite Designation	Composite Part Designation	Test Status	(All Concentrations in µg/L)											
				13	14	15	16	17	18	19	20	21	22	23	24
Background Soil	1	1	Test	<3	<30	<4	<3	<7	<2	<7	<5	<2	<3	<5	<4
Background Soil 2	1	1	Substitute	<3	<30	<4	<3	<7	<2	<7	<5	<2	<3	<5	<4
Drum Storage DSA	1	1	Test	<30	<250	<40	<30	<70	<20	<60	<50	<20	<30	<50	<40
	1	2	Test	<30	<250	<40	<30	<70	<20	<60	<50	<20	<30	<50	<40
Lagoon North LAN	1	1	Test	<3	<30	<4	<3	<7	<2	<6	<5	2.1	<3	<5	<4
	1	2	Test	<3	88	<4	<3	<7	<2	<6	<5	2.8	<3	<5	<4
	2	1	Test	<3	<30	<4	<3	<7	<2	<6	<5	2.2	<3	<5	<4
Filter Sludge FSA	1	3	Substitute	16	110	19	4	<7	<2	<6	<5	120	<3	<5	53[a]
	2	1	Substitute	33	320	29	<10	<40	<10	<30	<30	210	<20	<30	100[a]
Landfarm LFA	1	1	Test	<140	<1300	<190	<140	<350	<110	<300	<250	<95	<160	<250	<220
	1	2	Test	56	<500	<80	<60	<140	<40	<120	<100	<40	<60	<100	<90
Processing Facility PFA	1	1	Test	<30	<250	<40	<30	<70	<20	<60	<50	<20	<30	<50	<40
	1	2	Test	<110	<1000	<150	<110	<280	<88	<240	<200	<76	<120	<200	<180
Lagoon South LAS	1	1	Test	<3	<30	<4	<3	<7	<2	<6	<5	4.9	<3	<5	<4
	3	1	Test	<3	<30	<4	<3	<7	<2	<6	<5	5.7	<3	<5	<4
	4	1	Test	<3	<30	<4	<3	<7	<2	<6	<5	<2	<3	<5	<4
	5	1	Test	<3	<30	<4	<3	<7	<2	<6	<5	9.1	<3	<5	<4
	5	1	Reserve	<3	<30	<4	<3	<7	<2	<6	<5	19	<3	<5	<4

[a] Detected in Reagent Blank; background subtraction not performed.

(Continued)

TABLE A-10. (Continued)

Sample Source	Composite Designation	Composite Part Designation	Test Status	25	26	27	28	29	30	31	32	33	34	35	36
				(All Concentrations in μg/L)											
Background Soil	1	1	Test	<5	<15	<5	<40	<50	<4	<7	<6	<6	<7	6.4	<5
Background Soil 2	1	1	Substitute	<5	<5	<5	<40	<50	<4	<7	<6	<6	<7	6.1	<5
Drum Storage	1	1	Test	<50	<50	<50	<360	<460	<40	<70	910	<60	<70	<30	<50
DSA	1	2	Test	<50	<50	<50	<360	<460	<40	<70	920	<60	<70	<30	<50
Lagoon North	1	1	Test	<5	<5	<5	<40	<50	<4	<7	8.9	<6	<7	<3	7.3
LAN	1	2	Test	<5	<5	<5	<40	<50	<4	<7	10	<6	<7	<3	6.9
	2	1	Test	<5	<5	<5	<40	<50	<4	<7	10	<6	<7	<3	7
Filter Sludge	1	3	Substitute	<5	<5	<5	<41	420	14	<7	160	<6	55	<3	340
FSA	2	1	Substitute	<30	<30	<24	<180	1200	24	<35	330	<30	100	<15	710
Landfarm	1	1	Test	<250	<250	<240	<1800	<2300	<210	<350	6200	<300	<360	<150	<230
LFA	1	2	Test	<100	<100	<94	<720	<920	<80	<140	3900	<120	<140	<60	<90
Processing Facility	1	1	Test	<50	<50	<50	<360	<460	<40	<70	<60	<60	<70	<30	<50
PFA	1	2	Test	<200	<200	<190	<1400	<1800	<160	<280	2200	<240	<290	<120	<180
Lagoon South	1	1	Test	<5	<5	<5	<40	<50	<10	<7	<6	<6	<7	<3	13
LAS	3	1	Test	<5	<5	<5	<40	<50	7.4	<7	8.3	<6	<7	<3	30
	4	1	Test	<5	<5	<5	<40	<50	<4	<7	<6	<6	<7	<3	12
	5	1	Test	<5	<5	<5	<40	<50	6	<7	12	<6	<7	<3	35
	5	1	Reserve	<5	<5	<5	<40	<50	8.3	<7	21	<6	11	<3	93

[a] Detected in Reagent Blank; background subtraction not performed.

(Continued)

TABLE A-10. (Continued)

Key to VOCs

1. chloromethane
2. bromomethane
3. vinyl chloride
4. chloroethane
5. methylene chloride
6. acetone
7. carbon disulfide
8. trichlorofluoromethane
9. 1,1-dichloroethene
10. 1,1-dichloroethane
11. trans-1,2-dichloroethene
12. chloroform
13. 1,2-dichloroethane
14. 2-butanone
15. 1,1,1-trichloroethane
16. carbon tetrachloride
17. vinyl acetate
18. bromodichloromethane
19. 1,2-dichloropropane
20. cis-1,3-dichloropropene
21. trichloroethene
22. dibromochloromethane
23. 1,1,2-trichloroethane
24. benzene
25. trans-1,3-dichloropropene
26. 2-chloroethylvinyl ether
27. bromoform
28. 2-hexanone
29. 4-methyl-2-pentanone
30. tetrachloroethene
31. 1,1,2,2-tetrachloroethane
32. toluene
33. chlorobenzene
34. ethylbenzene
35. styrene
36. total xylenes

TABLE A-11. BASE-NEUTRAL-ACID (BNA) SEMI-VOLATILE ORGANIC COMPOUND CONCENTRATIONS IN TCLP EXTRACTS OF COMPOSITE UNTREATED SOILS FROM THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT

Sample Source	Composite Designation	Composite Part Designation	Test Status	(All Concentrations in µg/L)									
				1	2	3	4	5	6	7	8	9	10
Background Soil	1	1	Test	230	<10	<10	<10	<10	<10	<10	<10	<10	<10
Drum Storage DSA	1	1	Test	<10	<10	<10	12[a]	<10	<10	<10	<10	<10	12[a]
	1	2	Test	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Lagoon North LAN	1	1	Test	<10	<10	<10	10[a]	<10	34	260	330	230	<10
	1	2	Test	<10	91	<10	<10	<10	44	360	500	240	<10
	2	1	Test	<10	<10	<10	17[a]	<10	43	320	400	280	<10
Filter Sludge FSA	1	1	Test	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
	1	2	Test										
	1	3	Reserve	<10	27[a]	<10	18[a]	<10	580	840	1100	520	55
	2	1	Test	<10	<10	<10	<10	14[a]	1000	1500	1900	970	100
Landfarm LFA	1	1	Test	<10	<10	<10	14[a]	<10	<10	<10	<10	<10	<10
	1	2	Test	<10	<10	<10	18[a]	<10	<10	<10	<10	<10	<10
Processing Facility PFA	1	1	Test	<10	<10	<10	14[a]	<10	<10	<10	<10	<10	11[a]
	1	2	Test	<10	<10	<10	18[a]	<10	<10	<10	<10	<10	<10
Lagoon South LAS	1	1	Test	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
	3	1	Test	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
	4	1	Test	<10	<10	<10	<10	<10	<10	<10	<10	10[a]	11[a]
	5	1	Test	<10	<10	<10	24	<10	<10	<10	<10	<10	19
	5	2	Test	<10	<10	<10	<10	<10	<10	<10	<10	<10	11

[a] Numbers that are below five times the detection limit should not be considered to be quantitative.

Compound No.	Name
1	diethyl phthlate
2	di-n-butyl phthalate
3	benzo (a) anthracene
4	bis (2-ethylhexyl) phthalate
5	1,2-dichlorobenzene

Compound No.	Name
6	2-methylphenol
7	4-methylphenol
8	phenol
9	2,4-dimethylphenol
10	naphthalene

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TABLE A-11. (Continued)

BNA Compounds Not Detected			
Compound	Detection Limit	Compound	Detection Limit
acenaphthene	10	aniline	660
acenaphthylene	10	benzyl alcohol	1300
1-chloronaphthalene	10	bis(2-chloroethyl)ether	660
2-chloronaphthalene	10	bis(2-chloroisopropyl)ether	660
4-chlorophenyl phenyl ether	10	2-chlorophenol	660
dibenzofuran	10	1,3-dichlorobenzene	660
dimethyl phthalate	660	1,4-dichlorobenzene	660
2,4-dinitrophenol	10	ethyl methanesulfonate	660
2,4-dinitrotoluene	50	hexachloroethane	660
2,6-dinitrotoluene	10	methyl methanesulfonate	660
fluorene	660	n-nitrosodimethylamine	660
hexachlorocyclopentadiene	10	n-nitroso-di-n-propylamine	660
1-naphthylamine	10	2-picoline	660
2-naphthylamine	10	acetophenone	660
2-nitroaniline	50	benzoic acid	660
3-nitroaniline	50	bis(2-chloroethoxy)methane	660
4-nitroaniline	50	4-chloroaniline	1300
4-nitrophenol	50	4-chloro-3-methylphenol	1300
pentachlorobenzene	10	2,4-dichlorophenol	660
1,2,4,5-tetrachlorobenzene	10	2,6-dichlorophenol	660
2,3,4,6-tetrachlorophenol	10	a,a-dimethyl-phenethylamine	660
2,4,6-trichlorophenol	10	hexachlorobutadiene	660
2,4,5-trichlorophenol	10	isophorone	660
4-aminobiphenyl	10	2-methylnaphthalene	660
anthracene	660	nitrobenzene	660
4-bromophenyl phenyl ether	10	2-nitrophenol	660
4,6-dinitro-2-methylphenol	50	n-nitroso-di-n-butylamine	660
diphenylamine	660	n-nitrosopiperidine	660
1,2-diphenylhydrazine	10	1,2,4-trichlorobenzene	660
fluoranthene	660	benzo(b)fluoroanthene	660
hexachlorobenzene	10	benzo(k)fluoranthene	660
n-nitrosodiphenylamine	660	benzo(g,h,i)perylene	660
pentachlorophenol	3300	benzo(a)pyrene	660
pentachloronitrobenzene	10	dibenz(a,j)acridine	660
phenacetin	10	dibenz(a,h)anthracene	660
phenanthrene	660	12-dimethylbenz(a)anthracene	660
pronamide	660	di-n-octylphthalate	660
benzidine	10	indeno(1,2,3-cd)pyrene	660
butylbenzylphthalate	660	3-methylchloanthene	660
chrysene	660		
3,3'-dichlorobenzidine	20		
p-dimethylaminoazobenzene	660		
pyrene	660		

TABLE A-12. PRIORITY POLLUTANT METALS CONCENTRATIONS IN TCLP EXTRACTS OF COMPOSITE SOILS FROM THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT

Sample Source	Composite Designation	Composite Part Designation	Test Status	(All Concentrations in mg/L)					
				Cadmium	Chromium	Copper	Lead	Nickel	Zinc
Background Soil	1	1	Test	<0.003	<0.008	<0.03	0.02	<0.008	0.08
Drum Storage	1	1	Test	0.004	<0.008	<0.03	1.4	0.02	0.62
DSA	1	2	Test	0.004	<0.008	<0.03	1.7	0.02	0.8
	2	1	Partial						
Lagoon North	1	1	Test	0.02	<0.008	<0.03	31	0.07	1.15
LAN	1	2	Test	0.03	<0.008	<0.03	31	0.07	1.25
	1	3	Reserve						
	2	1	Test	0.02	<0.008	<0.03	33.5	0.07	0.95
	2	2	Partial						
Filter Sludge	1	1	Test						
FSA	1	2	Test						
	1	3	Reserve	0.06	0.04	<0.03	24.7	0.08	10.3
	2	1	Partial	0.2	0.5	0.6	11.2	0.13	35.7
	2	2	Partial						
Landfarm	1	1	Test	0.006	<0.008	<0.09	29.8	0.048	6.3
LFA	1	2	Test	0.06	<0.008	<0.08	25.6	0.07	7.0
	2	1	Partial						
	2	2	Partial						
Processing	1	1	Test	0.008	<0.008	<0.03	22.3	0.05	1.5
Facility	1	2	Test	0.010	<0.008	<0.03	22.5	0.04	1.4
PFA	2	1	Partial						
Lagoon South	1	1	Test	0.04	<0.008	0.2	58.1	0.07	4.8
LAS	1	2	Partial						
	2	1	Test						
	3	1	Reserve	0.04	<0.008	0.18	49.7	0.08	5.1
	4	1	Test						
	5	1	Test	0.04	<0.008	<0.14	50.1	0.07	4.5

TABLE A-13. OIL AND GREASE CONCENTRATIONS IN TCLP EXTRACTS OF COMPOSITE UNTREATED SOILS FROM THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT

Sample Source	Composite Designation	Composite Part Designation	Test Status	Oil & Grease in TCLP (mg/L)
Background Soil	1	1	Test	<0.2
Background Soil 2	1	1	Partial	
Drum Storage DSA	1	1	Test	<0.2
	1	2	Test	<0.2
	2	1	Partial	
Lagoon North LAN	1	1	Test	1.1
	1	2	Test	1.6
	2	1	Test	1.1
	2	2	Partial	
Filter Sludge FSA	1	1	Test	1.0
	1	2	Test	2.4
	2	1	Partial	7.8
Landfarm LFA	1	1	Test	3.6
	1	2	Test	0.3[a]
	2	1	Partial	
Processing Facility PFA	1	1	Test	<0.2
	1	2	Test	0.7[a]
	2	1	Partial	
Lagoon South LAS	1	1	Test	0.7[a]
	1	2	Partial	
	2	1	Test	0.8[a]
	3	1	Test	0.7[a]
	4	1	Test	0.6[a]
	5	1	Test	<0.4[a]

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[a] Indicates a value less than five times the detection limit.

TABLE A-14. PERMEABILITIES, BULK DENSITIES, AND MOISTURE CONTENTS OF TREATED SOILS COLLECTED AS SLURRIES FROM THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT

Sample Type	Mold Designation	Falling Head Permeability (cm/sec)	Date Permeability Test Started	Bulk Density (g/mL)	Moisture[a] (%)
Cement only	1	NA	--	1.99	11.2
	2	NA	--	1.95	8.7
	3	NA	--	2.01	9.8
Clean Soil + Cement	1	NA	--	1.90	14.1
	2	NA	--	1.87	13.4
	3	NA	--	1.88	12.3
Lagoon North + Cement	1	NA	--	1.60	21.1
	2	NA	--	1.60	18.7
	3	NA	--	1.60	19.1
Filter Cake + Cement	1	NA	--	1.40	29.3
	2	NA	--	1.42	29.4
	3	NA	--	1.42	26.0
Drum Storage	M1	5.3×10^{-10}	11-20-87	1.99	12.6
	M3	2.6×10^{-9}	11-16-87	1.90	15.7
	M4	Not Collected	--	--	--
Lagoon North	M1	1.3×10^{-9}	11-18-87	1.65	18.2
	M4	1.5×10^{-9}	11-30-87	1.61	21.1
	M5	2.3×10^{-9}	11-23-87	1.58	21.1
Filter Sludge	M1	2.9×10^{-9}	11-11-87	1.53	23.2
	M3	2.6×10^{-9}	12-01-87	1.49	25.8
	M5	8.0×10^{-9}	12-02-87	1.52	25.2
Landfarm	M1	2.1×10^{-9}	12-03-87	1.93	15.2
	M3	5.7×10^{-9}	12-04-87	1.79	18.2
	M5	5.8×10^{-9}	12-06-87	1.80	17.6
Processing Facility	M1	2.5×10^{-10}	11-24-87	2.08	11.7
	M2	1.2×10^{-8}	1-09-88	2.09	11.3
	M3	7.0×10^{-10}	12-17-87	2.04	11.7
Lagoon South	SM2	3.9×10^{-10}	11-26-87	1.72	15.1
	LM1	3.6×10^{-9}	2-08-88	1.67	17.0
	LM2A	4.1×10^{-9}	1-27-88	1.71	18.1
	LM2B	2.6×10^{-9}	1-25-88	1.72	17.9
	LM2C	1.2×10^{-9}	1-07-88	1.70	13.6

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[a] Calculated from weight loss at 60°C; Moisture = $\frac{\text{(wet weight - dry weight)}}{\text{wet weight}} \times 100$

NA - Not Analyzed.

TABLE A-15. UNCONFINED COMPRESSIVE STRENGTH OF TREATED SOILS COLLECTED AS SLURRIES FROM THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT

Sample Type	Mold Designation	UCS 1 (psi)	UCS 2 (psi)	UCS 3 (psi)	UCS Avg. (psi)	UCS Std. Dev. (psi)	UCS CV (%)
Cement Only	1	1370	1575	2330	1758	413	23
Background Soil + Cement	1	2575	1650	1775	2000	410	20
Lagoon North + Cement	1	405	405	308	373	46	12
Filter Sludge + Cement	1	25	28	28	27	1	5
Drum Storage	M1	1586	2243	1396	1742	363	21
	M3	1018	1197	1242	1152	97	8
	Not Collected						
Lagoon North	M1	579	565	551	565	11	2
	M4	408	372	383	388	15	4
	M5	285	352	350	329	31	9
Filter Sludge	M1	229	103	235	189	61	32
	M3	338	296	283	306	23	8
	M5	266	246	148	220	52	23
Landfarm	M1	887	1362	1192	1147	197	17
	M3	971	649	1049	890	173	19
	M5	1001	951	464	805	242	30
Processing Facility	M1	1893	1183	1846	1641	324	20
	M2	702	1558	1371	1210	367	30
	M3	1189	1779	1397	1455	244	17
Lagoon South	SM2	929	1116	1222	1089	121	11
	LM1	1108	1021	985	1038	52	5
	LM2A	613	604	657	625	23	4
	LM2B	769	629	571	656	83	13
	LM2C	1091	1057	1035	1061	23	2

TABLE A-16. VOLATILE ORGANIC COMPOUND CONCENTRATIONS IN TREATED SOILS COLLECTED AS SLURRIES FROM THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT

Sample Source	Mold Designation	(All Concentrations in µg/L) 1	2	3	4	5	6	7	8	9	10	11	12
Background Soil	1	<6	<6	<6	<6	<6	4	<2	<6	<6	<4	<2	<2
Drum Storage	M1	<30	<30	<30	<30	34	270^a	<10	<30	<30	<20	<10	<10
DSA	M3	<60	<60	<60	<60	66	260^a	<20	<60	<60	<30	<20	<20
Lagoon North	M1	<30	<30	<30	<30	<20	2000^a	<10	<30	<30	<20	<10	<10
LAN	M4	<30	<30	<30	<30	<20	1800^a	<10	<30	<30	<20	<10	<10
	M5	<30	<30	<30	<30	150^a	2400^a	<10	<30	<30	<20	<10	<10
Filter Sludge	M1	<810	<810	<810	<810	<450	4100^a	<280	<810	<760	<450	<260	<260
FSA	M1 DUP	<810	<810	<810	<810	<450	4000^a	<280	<810	<760	<450	<260	<260
	M3	<760	<760	<760	<760	<430	2300^a	<260	<760	<710	<430	<240	<240
	M5	<880	<880	<880	<880	<490	7700^a	<300	<880	<830	<490	<280	<280
Landfarm	M1	<60	<60	<60	<60	70^a	190^a	<20	<60	<56	<33	<19	<19
LFA	M3	<760	<760	<760	<760	<430	4900^a	<260	<760	<710	<430	<240	<240
	M5	<630	<630	<630	<630	<350	1300^a	<210	<630	<590	<350	<200	<200
Processing	M1	<3100	<3100	<3100	<3100	<1800	<4700	<1100	<3100	<2900	<1800	<1000	<1000
Facility	M2	<700	<700	<700	<700	<390	1400^a	<240	<700	<660	<390	<220	<220
PFA	M3	<630	<630	<630	<630	<350	<940	<210	<630	<590	<350	<200	<200
Lagoon South	SM2	<710	<710	<710	<710	<400	3400^a	<240	<710	<670	<400	<230	<230
LAS	LM1	<60	<60	<60	<60	71	480^a	<20	<60	<60	<30	<20	<20
	LM2A	<5	<5	<5	<5	5.8	91^a	<2	<5	<5	<3	<2	<2
	LM2B	<30	<30	<30	<30	34	730^a	<10	<30	<30	<17	<10	<10
	LM2B DUP	<30	<30	<30	<30	81	540^a	<10	<30	<30	<17	<10	<10
	LM2C	<30	<30	<30	<30	32^a	2900^a	<10	<30	<30	<17	<10	<10

^{a}Detected in Reagent Blank; background subtraction not performed

(Continued)

TABLE A-16. (Continued)

Sample Source	Mold Designation	(All Concentrations in µg/L)											
		13	14	15	16	17	18	19	20	21	22	23	24
Background Soil	1	<4	<30	<5	<4	<8	<3	<7	<6	<2	<4	5	5
Drum Storage DSA	M1	<20	<140	<20	<20	<40	<10	<30	<30	<10	<20	<30	<30
	M3	<30	<290	<40	<30	<80	<30	<70	<60	<20	<40	<50	<50
Lagoon North LAN	M1	<20	700	<20	<20	<40	<10	<40	<30	54	<20	<30	<30
	M4	<20	760	<20	<20	<40	<10	<40	<30	67	<20	<30	<30
	M5	<20	850	<20	<20	<40	<10	<40	<30	84	<20	29[a]	29[a]
Filter Sludge FSA	M1	<450	8100[a]	2000	640	<1100	<360	<970	<810	13000	<500	<810	2600
	M1 DUP	<450	8400[a]	1600	620	<1100	<360	<970	<810	13000	<500	<810	2600
	M3	<430	4600[a]	730	<430	<1000	<330	<910	<760	5100	<470	<760	1000
	M5	<490	6500[a]	<670	<490	<1200	<390	<1100	<880	4400	<550	<880	<770
Landfarm LFA	M1	<30	<300	<50	<30	<80	<30	<70	<60	<20	<40	<60	57[a]
	M3	<430	3900	<580	<430	<1000	<330	<910	<760	<290	<470	<760	<670
	M5	<350	<3100	<480	<350	<860	<280	<750	<630	<240	<390	<630	<550
Processing Facility PFA	M1	<1800	<16000	<2400	<1800	<4300	<1400	<3800	<3100	<1200	<1900	<3100	<2800
	M2	<390	4100	<530	<390	<970	<310	<840	<700	<270	<430	<700	<620
	M3	<350	<3100	<480	<350	<860	<280	<750	<630	<240	<390	<630	<550
Lagoon South LAS	SM2	<400	3900[a]	<540	<400	<980	<310	<860	<710	600	<440	<710	<630
	LM1	<30	<300	<50	<30	<80	<30	<70	<60	42	<40	<60	<50
	LM2A	<30	27	<4	<3	<7	<2	<6	<5	14	<3	<5	<4
	LM2B	<20	210	<20	<17	<42	<1	<40	<30	60	<20	<30	<30
	LM2B DUP	<20	<150	<20	<17	<42	<1	<40	<30	41	<20	<30	<30
	LM2C	<20	<150	27	<17	<42	<1	<40	<30	270	<20	<30	31[a]

[a] Detected in Reagent Blank; background subtraction not performed.

(Continued)

TABLE A-16. (Continued)

		(All Concentrations in µg/L)											
Sample Source	Mold Designation	25	26	27	28	29	30	31	32	33	34	35	36
Background Soil	1	<6	<6	<6	<40	<60	<5	<8	1	<7	<9	<4	<6
Drum Storage	M1	<30	<30	<30	<200	<260	<20	<40	1300	<30	<40	<20	<30
DSA	M3	<60	<60	<60	<420	<530	<50	<80	1400	<70	<80	<40	<50
Lagoon North	M1	<30	<30	<30	400	<270	107	<40	370	<40	150	<20	910
LAN	M4	<30	<30	<30	480	<290	110	<40	310	<40	170	<20	970
	M5	<30	<30	<30	520	<290	160	<40	880	<40	230	<20	1300
Filter Sludge	M1	<810	<810	<760	6400	13000	6800	<1100	26000	<970	17000	<490	100000
FSA	M1 DUP	<810	<810	<760	6800	14000	6100	<1100	33000	<970	16000	<490	87000
	M3	<760	<760	<710	<5500	<7000	2900	<1000	15000	<910	6800	<460	34000
	M5	<880	<880	<830	<6300	<8100	2900	<1200	8800	<1100	8100	<530	47000
Landfarm	M1	<60	<60	<60	<430	<550	<50	<80	2500[a]	<70	<90	<40	<60
LFA	M3	<760	<760	<710	<5500	<7000	<620	<1000	28000	<910	<1100	<460	<700
	M5	<630	<630	<590	<4500	<5800	<510	<860	5800	<750	<900	<380	<380
Processing	M1	<3100	<3100	<2900	<23000	<29000	<2600	<4300	<3800	<3800	<4500	<1900	<2900
Facility	M2	<700	<700	<660	<5000	<6400	<570	<970	10000	<840	<1000	<420	3200
PFA	M3	<630	<630	<590	<4500	<5800	<510	<860	3700	<750	<900	<380	<580
Lagoon South	SM2	<710	<710	<670	<5100	<6600	3500	<980	1200	<860	1400	<430	12000
LAS	LM1	<60	<60	<60	<420	<540	610	<80	360	<70	130	<40	1100
	LM2A	<5	<5	<5	<40	<50	92	<7	69	<6	30	<3	250
	LM2B	<30	<30	<30	<220	<280	480	<42	400	<40	160	<20	1400
	LM2B DUP	<30	<30	<30	<220	<280	500	<42	290	<40	150	<20	1300
	LM2C	<30	<30	<30	<580	<290	1700	<42	2400	<40	690	<20	5300

[a] Detected in Reagent Blank; background subtraction not performed.

(Continued)

TABLE A-16. (Continued)

Key to VOCs

1. chloromethane
2. bromomethane
3. vinyl chloride
4. chloroethane
5. methylene chloride
6. acetone
7. carbon disulfide
8. trichlorofluoromethane
9. 1,1-dichloroethene
10. 1,1-dichloroethane
11. trans-1,2-dichloroethene
12. chloroform
13. 1,2-dichloroethane
14. 2-butanone
15. 1,1,1-trichloroethane
16. carbon tetrachloride
17. vinyl acetate
18. bromodichloromethane
19. 1,2-dichloropropane
20. cis-1,3-dichloropropene
21. trichloroethene
22. dibromochloromethane
23. 1,1,2-trichloroethane
24. benzene
25. trans-1,3-dichloropropene
26. 2-chloroethylvinyl ether
27. bromoform
28. 2-hexanone
29. 4-methyl-2-pentanone
30. tetrachloroethene
31. 1,1,2,2-tetrachloroethane
32. toluene
33. chlorobenzene
34. ethylbenzene
35. styrene
36. total xylenes

TABLE A-17. POLYCHLORINATED BIPHENYLS (PCBs) CONCENTRATIONS IN TCLP EXTRACTS OF TREATED SOILS COLLECTED AS SLURRIES FROM THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT ESTIMATED BY GAS CHROMATOGRAPHY METHOD 8080

Sample Type	Set Number	PCBs by 8080
Drum Storage	M1	NP[a]
	M3	NP
Lagoon North	M1	680 HA[b]
	M4	680 HA
	M5	680 HA
Filter Sludge	M1	680 LA[c]
	M3	680 HA
	M5	680 HA
Landfarm	M1	B 680[d]
	M3	B 680
	M5	B 680
Processing Facility	M1	680 HA
	M2	B 680
	M3	B 680
Lagoon South	SM2	680 LA
	LM1	680 LA
	LM2A	680 LA
	LM2B	680 HA
	LM2C	680 LA

[a] No discernible peaks.
[b] Candidate for 680 test; high level, Group A.
[c] Candidate for 680 test; low level, Group A.
[d] Peaks detected, but below 680 method detection limit.

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TABLE A-18. POLYCHLORINATED BIPHENYLS (PCBs) CONCENTRATIONS IN TCLP EXTRACTS OF TREATED SOILS COLLECTED AS SLURRIES FROM THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT ESTIMATED BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY METHOD 680

		(All Concentrations in μg/L)									
Sample Source	Mold Designation	Monochloro-Biphenyl	Dichloro-Biphenyl	Trichloro-Biphenyl	Tetrachloro-Biphenyl	Penta Biphenyl	Hexa Biphenyl	Hepta Biphenyl	Octa Biphenyl	Nona Biphenyl	Deca Biphenyl
Drum Storage DSA	M1	NA[a]	NA	NA	NA	NA	NA	NA	NA	NA	NA
	M3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lagoon North LAN	M1	<0.05	<0.07	<0.07	<0.12	<0.10	<0.12	<0.18	<0.35	<0.30	<0.33
	M4	<0.05	<0.07	<0.07	<0.12	<0.10	<0.12	<0.18	<0.35	<0.30	<0.33
	M5	<0.05	<0.07	<0.07	<0.12	<0.10	<0.12	<0.18	<0.35	<0.30	<0.33
Filter Sludge FSA	M1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	M3	<0.05	<0.07	<0.07	<0.12	<0.10	<0.12	<0.18	<0.35	<0.30	<0.33
	M5	<0.05	<0.07	<0.07	<0.12	<0.10	<0.12	<0.18	<0.35	<0.30	<0.33
Landfarm LFA	M1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	M3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	M5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Processing Facility PFA	M1	<0.05	<0.07	<0.07	<0.12	<0.10	<0.12	<0.18	<0.35	<0.30	<0.33
	M2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	M3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lagoon South LAS	SM2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	LM1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	LM2A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	LM2B	<0.05	<0.07	<0.07	<0.12	<0.10	<0.12	<0.18	<0.35	<0.30	<0.33
	LM2C	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

[a] Not analyzed.

TABLE A-19. VOLATILE ORGANIC COMPOUND CONCENTRATIONS IN TCLP EXTRACTS OF TREATED SOILS COLLECTED AS SLURRIES FROM THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT

Sample Source	Mold Designation	(All Concentrations in μg/L)											
		1	2	3	4	5	6	7	8	9	10	11	12
Background Soil	1	<5	<5	<5	<5	3	18	2	<5	<5	<3	<2	<2
Drum Storage DSA	M1	<5	<5	<5	<5	27	35	<2	<5	<5	<3	<2	<2
	M3	<30	<30	<30	<30	<10	82	<9	<30	<20	<10	<8	<8
Lagoon North LAN	M1	<5	<5	<5	<5	13	110	<2	<5	<5	<3	<2	<2
	M4	<5	<5	<5	<5	<3	35	<2	<5	<5	<3	<2	<2
	M4 DUP	<5	<5	<5	<5	<3	35	<2	<5	<5	<3	<2	<2
	M5	<5	<5	<5	<5	<3	26	<2	<5	<5	<3	<2	<2
Filter Sludge FSA	M1	<30	<30	<30	<30	<10	230	<9	<30	<20	<10	<8	<8
	M3	<30	<30	<30	<30	<10	220[a]	<9	<30	<20	<10	<8	<8
	M5	<5	<5	<5	<5	40	180[a]	<2	<5	<5	<3	<2	<2
Landfarm LFA	M1	<5	<5	<5	<5	<3	24[a]	<2	<5	<5	<3	<2	<2
	M3	<5	<5	<5	<5	16	27[a]	<2	<5	<5	<3	<2	<2
	M5	<5	<5	<5	<5	14	62	<2	<5	<5	<3	<2	<2
Processing Facility PFA	M1	<5	<5	<5	<5	14	24[a]	<2	<5	<5	<3	2.1	<2
	M2	<13	<13	<13	<13	7.2	33	<4	<13	<12	<7	4.7	<4
	M3	<13	<13	<13	<13	<7	32	<4	<13	<12	<7	<4	<4
Lagoon South LAS	SM2	<13	<13	<13	<13	<7	38	<4	<13	<12	<7	<4	<4
	LM1	<10	<10	<10	<10	7.5	42	<3	<10	<10	<6	<3	<3
	LM2A	<10	<10	<10	<10	6	100	<5	<5	<5	<5	<5	<5
	LM2B	<5	<5	<5	<5	4.6	53	<2	<5	<5	<3	<2	<2
	LM2C	<5	<5	<5	<5	13	51	<2	<5	<5	<3	<2	<2

[a] Detected in Reagent Blank; background subtraction not performed.

(Continued)

TABLE A-19. (Continued)

Sample Source	Mold Designation	(All Concentrations in µg/L) 13	14	15	16	17	18	19	20	21	22	23	24
Background Soil	1	<3	<30	<4	<3	<7	<2	<6	<5	<2	<3	<5	<5
Drum Storage	M1	<3	<30	<4	<3	<7	<2	<6	<5	<2	<3	<5	<4
DSA	M3	<10	<130	<20	<10	<40	<10	<30	<30	<10	<20	<30	<20
Lagoon North	M1	<3	47	<4	<3	<7	<2	<6	<5	2.7	<3	<5	<4
LAN	M4	<3	<30	<4	<3	<7	<2	<6	<5	<2	<3	<5	<4
	M4 DUP	<3	<30	<4	<3	<7	<2	<6	<5	<2	<3	<5	<4
	M5	<3	<30	<4	<3	<7	<2	<6	<5	<2	<3	<5	<4
Filter Sludge	M1	<10	<130	<20	<10	<40	<10	<30	<30	100	<20	77	27
FSA	M3	<10	<130	23	<10	<40	<10	<30	<30	160	<20	150	43
	M5	5	140	7	<3	<7	<2	<6	<5	55	<3	<5	15
Landfarm	M1	<3	<30	<4	<3	<7	<2	<6	<5	<2	<3	<5	<4
LFA	M3	<3	<30	<4	<3	<7	<2	<6	<5	<2	<3	<5	<4
	M5	<3	<30	<4	<3	<7	<2	<6	<5	<2	<3	<5	<4
Processing	M1	<3	<30	<4	<3	<7	<2	<6	<5	<2	<3	<5	<4
Facility	M2	<7	<60	<10	<7	<20	<6	<15	<13	<5	<8	<13	<10
PFA	M3	<7	<60	<10	<7	<20	<6	<15	<13	<5	<8	<13	<10
Lagoon South	SM2	<7	<60	<10	<7	<20	<6	<15	<13	<5	<8	<13	<10
LAS	LM1	<6	<50	<8	<6	<14	<5	<12	<10	<4	<6	<10	<10
	LM2A	<5	<100	<5	<5	<50	<5	<5	<5	<5	<5	<5	<5
	LM2B	<3	<25	<4	<3	<7	<2	<6	<5	4.7	<3	<5	<4
	LM2C	<3	<25	<4	<3	<7	<2	<6	<5	5.0	<3	<5	<4

[a] Detected in Reagent Blank; background subtraction not performed.

(Continued)

TABLE A-19. (Continued)

Sample Source	Mold Designation	(All Concentrations in µg/L)											
		25	26	27	28	29	30	31	32	33	34	35	36
Background Soil	1	<5	<5	<5	<40	<50	<4	<7	<6	<6	<7	6	<5
Drum Storage DSA	M1	<5	<5	<5	<40	<50	<4	<7	240	<6	<7	6.9	7.2
	M3	<30	<30	<24	<180	<230	<20	<40	520	<30	<40	<20	<20
Lagoon North LAN	M1	<5	<5	<5	<40	<50	<4	<7	8.5	<6	<7	<3	14
	M4	<5	<5	<5	<40	<50	<4	<7	<6	<6	<7	<3	<5
	M4 DUP	<5	<5	<5	<40	<50	<4	<7	<6	<6	<7	<3	5.3
	M5	<5	<5	<5	<40	<50	<4	<7	<6	<6	<7	<3	5.4
Filter Sludge FSA	M1	<30	<30	<20	<180	260	<20	<40	220	<30	61	<20	390
	M3	<30	<25	<20	<180	420	21	<40	300	<30	70	<20	210
	M5	<5	<5	<5	<25	280	12	<7	130	<6	54	<3	420
Landfarm LFA	M1	<5	<5	<5	<40	<50	<4	<7	300	<6	<7	<3	7.1
	M3	<5	<5	<5	<40	<50	<4	<7	190	<6	<7	5	9
	M5	<5	<5	<5	<40	<50	<4	<7	130	<6	<7	<3	<5
Processing Facility PFA	M1	<5	<5	<5	<40	<50	<4	<7	330	<6	<7	<3	18
	M2	<13	<13	<12	<100	<120	<10	<20	410	<15	<20	<8	26
	M3	<13	<13	<12	<100	<120	<10	<20	300	<15	<20	<8	17
Lagoon South LAS	SM2	<13	<13	<12	<100	<120	<10	<20	<15	<15	<20	<8	<12
	LM1	<10	<10	<10	<70	<100	<8	<14	<12	<12	<14	<6	16
	LM2A	<5	<15	<5	<50	<50	<5	<5	<5	<5	<5	<5	6
	LM2B	<5	<5	<5	<40	<50	6.8	<7	9.5	<6	<7	3.1	19
	LM2C	<5	<5	<5	<40	<50	5.3	<7	7.1	<6	<7	<3	33

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[a] Detected in Reagent Blank; background subtraction not performed.

(Continued)

TABLE A-19. (Continued)

Key to VOCs

1. chloromethane
2. bromomethane
3. vinyl chloride
4. chloroethane
5. methylene chloride
6. acetone
7. carbon disulfide
8. trichlorofluoromethane
9. 1,1-dichloroethene
10. 1,1-dichloroethane
11. trans-1,2-dichloroethene
12. chloroform
13. 1,2-dichloroethane
14. 2-butanone
15. 1,1,1-trichloroethane
16. carbon tetrachloride
17. vinyl acetate
18. bromodichloromethane
19. 1,2-dichloropropane
20. cis-1,3-dichloropropene
21. trichloroethene
22. dibromochloromethane
23. 1,1,2-trichloroethane
24. benzene
25. trans-1,3-dichloropropene
26. 2-chloroethylvinyl ether
27. bromoform
28. 2-hexanone
29. 4-methyl-2-pentanone
30. tetrachloroethene
31. 1,1,2,2-tetrachloroethane
32. toluene
33. chlorobenzene
34. ethylbenzene
35. styrene
36. total xylenes

TABLE A-20. BASE-NEUTRAL-ACID (BNA) SEMI-VOLATILE ORGANIC COMPOUND CONCENTRATIONS IN TCLP EXTRACTS OF TREATED SOILS COLLECTED AS SLURRIES FROM THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT

Sample Source	Mold Designation	(All Concentrations in μg/L)									
		1	2	3	4	5	6	7	8	9	10
Drum Storage DSA	M1	<10	<10	<10	11[a]	<10	<10	32	36	14[a]	15[a]
	M3	<10	<10	<10	<10	<10	<10	<10	<10	<10	17
Lagoon North LAN	M1	<10	<10	<10	61	<10	19[a]	530	630	440	<10
	M4	<10	<10	<10	17[a]	<10	<10	400	500	240	<10
	M5	<10	<10	<10	17[a]	<10	<10	<10	780	420	<10
Filter Sludge FSA	M1	<10	<10	<10	20[a]	13[a]	560	1300	2200	510	65
	M3	<10	<10	<10	<10	11[a]	570	1400	2200	530	69
	M5	<10	<10	<10	<10	<10	340	740	710	500	50
Landfarm LFA	M1	<10	<10	<10	32	<10	<10	18[a]	<10	<10	11[a]
	M3	<10	<10	<10	<10	<10	<10	19[a]	12[a]	10[a]	18[a]
	M5	<10	<10	<10	12[a]	<10	<10	<10	26[a]	11[a]	<10
Processing Facility PFA	M1	<10	<10	<10	46	<10	<10	14[a]	<10	12[a]	<10
	M2	<10	<10	<10	<10	11[a]	<10	32	38	14[a]	40
	M3	<10	12[a]	<10	11[a]	<10	<10	<10	33	<10	29[a]
Lagoon South LAS	SM2	<10	11[a]	<10	<10	<10	21[a]	220	270	72	<10
	LM1	<10	<10	23[a]	<10	<10	41	310	350	120	14[a]
	LM2A	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
	LM2B	<10	<10	<10	20[a]	<10	30	290	91	60	<10
	LM2C	<10	<10	<10	23[a]	<10	18[a]	170	230	47	12[a]

[a] Less than 5 times the detection limit.

Compound No.	Name	Compound No.	Name
1	diethylphthlate	6	2-methylphenol
2	di-n-butyl phthalate	7	4-methylphenol
3	benzo(a)anthracene	8	phenol
4	bis(2-ethylhexyl)phthalate	9	2,4-dimethylphenol
5	1,2-dichlorobenzene	10	naphthalene

TABLE A-20. (Continued)

BNA Compounds Not Detected			
Compound	Detection Limit	Compound	Detection Limit
acenaphthene	10	aniline	660
acenaphthylene	10	benzyl alcohol	1300
1-chloronaphthalene	10	bis(2-chloroethyl)ether	660
2-chloronaphthalene	10	bis(2-chloroisopropyl)ether	660
4-chlorophenyl phenyl ether	10	2-chlorophenol	660
dibenzofuran	10	1,3-dichlorobenzene	660
dimethyl phthalate	660	1,4-dichlorobenzene	660
2,4-dinitrophenol	10	ethyl methanesulfonate	660
2,4-dinitrotoluene	50	hexachloroethane	660
2,6-dinitrotoluene	10	methyl methanesulfonate	660
fluorene	660	n-nitrosodimethylamine	660
hexachlorocyclopentadiene	10	n-nitroso-di-n-propylamine	660
1-naphthylamine	10	2-picoline	660
2-naphthylamine	10	acetophenone	660
2-nitroaniline	50	benzoic acid	660
3-nitroaniline	50	bis(2-chloroethoxy)methane	660
4-nitroaniline	50	4-chloroaniline	1300
4-nitrophenol	50	4-chloro-3-methylphenol	1300
pentachlorobenzene	10	2,4-dichlorophenol	660
1,2,4,5-tetrachlorobenzene	10	2,6-dichlorophenol	660
2,3,4,6-tetrachlorophenol	10	a,a-dimethyl-phenethylamine	660
2,4,6-trichlorophenol	10	hexachlorobutadiene	660
2,4,5-trichlorophenol	10	isophorone	660
4-aminobiphenyl	10	2-methylnaphthalene	660
anthracene	660	nitrobenzene	660
4-bromophenyl phenyl ether	10	2-nitrophenol	660
4,6-dinitro-2-methylphenol	50	n-nitroso-di-n-butylamine	660
diphenylamine	660	n-nitrosopiperidine	660
1,2-diphenylhydrazine	10	1,2,4-trichlorobenzene	660
fluoranthene	660	benzo(b)fluoroanthene	660
hexachlorobenzene	10	benzo(k)fluoranthene	660
n-nitrosodiphenylamine	660	benzo(g,h,i)perylene	660
pentachlorophenol	3300	benzo(a)pyrene	660
pentachloronitrobenzene	10	dibenz(a,j)acridine	660
phenacetin	10	dibenz(a,h)anthracene	660
phenanthrene	660	12-dimethylbenz(a)anthracene	660
pronamide	660	di-n-octylphthalate	660
benzidine	10	indeno(1,2,3-cd)pyrene	660
butylbenzylphthalate	660	3-methylchloanthene	660
chrysene	660		
3,3'-dichlorobenzidine	20		
p-dimethylaminoazobenzene	660		
pyrene	660		

TABLE A-21. SIX PRIORITY POLLUTANT METALS CONCENTRATIONS IN TCLP EXTRACTS OF TREATED SOILS COLLECTED AS SLURRIES FROM THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT

Sample Source	Mold Designation	(All Concentrations in mg/L)					
		Cadmium	Chromium	Copper	Lead	Nickel	Zinc
Drum Storage	M1	<0.04	<0.07	<0.06	<0.002	<0.15	<0.02
DSA	M3	<0.04	<0.07	<0.06	0.03	<0.15	<0.02
Lagoon North	M1	<0.04	<0.07	<0.06	<0.002	<0.15	<0.02
LAN	M4	<0.04	<0.07	<0.06	0.013	<0.15	<0.02
	M5	<0.04	<0.07	<0.06	<0.002	<0.15	0.02
Filter Storage	M1	<0.04	<0.07	<0.06	0.05	<0.15	<0.02
FSA	M3	<0.003	0.026	<0.03	0.010	<0.008	0.028
	M5	<0.003	0.020	<0.03	0.159	<0.008	0.019
Landfarm	M1	<0.04	<0.07	<0.06	0.05	<0.15	<0.02
LFA	M3	<0.04	<0.07	<0.06	0.03	<0.15	0.03
	M5	<0.003	<0.008	<0.08	0.041	0.008	0.052
Processing	M1	<0.04	<0.07	<0.06	<0.002	<0.15	<0.02
Facility	M2	<0.04	<0.07	<0.06	0.007	<0.15	<0.02
PFA	M3	<0.003	0.010	<0.03	0.019	<0.008	0.045
Lagoon South	SM2	<0.003	<0.008	<0.05	0.142	<0.008	0.054
LAS	LM1	<0.04	<0.07	<0.06	0.006	<0.15	<0.02
	LM2A	<0.003	<0.008	<0.05	0.179	<0.008	0.067
	LM2B	<0.003	<0.008	<0.06	0.142	<0.008	0.054
	LM2C	<0.003	<0.008	<0.05	0.159	<0.008	0.021

TABLE A-22. OIL AND GREASE CONCENTRATIONS IN TCLP EXTRACTS OF TREATED SOILS COLLECTED AS SLURRIES FROM THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT

Sample Type	Mold Designation	Oil & Grease in TCLP (mg/L)
Drum Storage	M1	<0.2
	M3	1.0[a]
	M3 Duplicate	0.9[a]
Lagoon North	M1	4.4
	M4	2.6
	M5	5.3
Filter Sludge	M1	4.5
	M3	4.5
	M5	3.2
Landfarm	M1	2.8
	M3	2.5
	M5	3.2
Processing Facility	M1	0.06[a]
	M2	1.4
	M3	1.3
	M3 Duplicate	1.3
Lagoon South	SM2	3.3
	LM1	1.7
	LM2A	1.8
	LM2B	1.7
	LM2C	3.5
	LM2C Duplicate	3.3

[a] Value is less than five times the detection limit.

TABLE A-23. PERMEABILITIES, BULK DENSITIES, AND MOISTURE CONTENTS OF TREATED SOILS COLLECTED AS FIELD CORES FROM THE HAZCON DOUGLASSVILLE DEMONSTRATION PROJECT

Sample Type	Core Designation	Falling Head Permeability (cm/sec)	Date Permeability Test Started	Bulk Density 1 (g/mL)	Bulk Density 2 (g/mL)	Bulk Density 3 (g/mL)	Bulk Density Avg. (g/mL)	Moisture[a] 1 (%)	Moisture 2 (%)	Moisture 3 (%)	Moisture Avg. (%)
Cement Mortar	1	--	--	2.07	2.07	2.07	2.07	11.2	11.6	10.3	11.0
Background Soil + Cement	1	5.9×10^{-9}	1-21-88	2.03	2.05	2.04	2.04	13.0	12.9	13.2	13.0
Filter Cake + Cement	1	3.2×10^{-8}	1-23-88	1.36	1.37	1.36	1.36	29.5	28.8	28.3	28.9
Lagoon North + Cement	1	3.8×10^{-8}	1-21-88	1.56	1.54	1.55	1.55	20.4	20.6	20.8	20.6
Drum Storage	DSA 1	2.3×10^{-9}	1-30-88	2.01	1.94	2.02	1.99	15.5	11.4	15.0	14.0
	DSA 3	7.2×10^{-10}	1-30-88	1.98	1.97	2.01	1.99	15.6	15.5	14.6	15.2
	DSA 4	2.3×10^{-9}	2-01-88	2.00	2.01	1.98	2.00	14.7	15.2	15.3	15.1
Lagoon North	LAN 1	2.8×10^{-9}	2-01-88	1.60	1.59	1.57	1.59	16.3	16.8	16.7	16.6
	LAN 4	6.0×10^{-9}	1-15-88	1.59	1.61	1.58	1.59	18.8	17.1	17.1	17.7
	LAN 5	2.1×10^{-9}	1-13-88	1.61	1.56	1.59	1.59	17.1	17.6	16.9	17.2
Filter Sludge	FSA 1	8.1×10^{-8}	1-11-88	1.50	1.51	No Sample	1.00	25.2	21.6	No Sample	23.4
	FSA 3	1.1×10^{-8}	1-12-88	1.53	1.51	1.49	1.51	21.3	21.3	22.4	21.7
	FSA 5	1.6×10^{-7}	1-12-88	1.51	1.52	1.50	1.51	20.9	20.8	22.0	21.2
Landfarm	LFA 1	2.1×10^{-9}	12-03-87	1.87	1.83	1.84	1.85	15.3	14.6	14.7	14.9
	LFA 3	5.7×10^{-9}	12-04-87	1.88	1.83	1.85	1.85	14.7	14.5	16.3	15.2
	LFA 5	5.8×10^{-9}	12-06-87	1.87	1.87	1.90	1.88	15.2	15.4	15.3	15.3
Processing Facility	PFA 1	2.4×10^{-9}	11-24-87	2.00	2.03	2.02	2.02	9.6	7.1	10.0	8.9
	PFA 2	1.2×10^{-8}	1-09-88	2.04	2.01	2.02	2.02	10.4	9.4	11.3	10.4
	PFA 3	7.0×10^{-10}	12-14-87	2.00	2.00	2.03	2.01	11.5	11.9	9.1	10.8
Lagoon South	LAS SM2	1.6×10^{-9}	2-03-88	1.73	1.73	1.75	1.74	14.8	14.8	15.7	15.1
	LAS LM1	1.5×10^{-9}	1-23-88	1.75	1.72	1.72	1.73	13.5	16.6	16.8	15.6
	LAS LM2A	4.1×10^{-9}	1-27-88	1.74	1.71	1.75	1.73	14.7	16.3	15.2	15.4
	LAS LM2B	2.6×10^{-9}	1-25-88	1.75	1.75	1.77	1.76	17.9	17.8	17.4	17.7
	LAS LM2C	1.2×10^{-9}	1-07-88	1.78	1.76	1.75	1.76	15.9	14.2	15.3	15.1

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[a] Calculated from weight loss at 60°C; moisture = $\frac{\text{(wet weight - dry weight)}}{\text{wet weight}} \times 100$.

TABLE A-24. UNCONFINED COMPRESSIVE STRENGTH OF TREATED SOILS COLLECTED AS FIELD CORES FROM THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT

Sample Type	Core Designation	UCS 1	UCS 2	UCS 3	UCS Avg.	UCS Std. Dev.	UCS CV[a] (%)
Cement Mortar	1	3711	2735	2400	2949	556	19
Background Soil + Cement	1	2340	2160	4225	2908	934	32
Filter Cake + Cement	1	39	37	37	38	1	3
Lagoon North + Cement	1	623	497	498	539	59	11
Drum Storage	DSA 1	1368	1545	1789	1567	173	11
	DSA 3	741	399	1400	847	415	49
	DSA 4	1119	608	1045	924	276	30
Lagoon North	LAN 1	298	549	618	488	138	28
	LAN 4	513	480	479	491	16	3
	LAN 5	376	667	735	593	156	26
Filter Sludge	FSA 1	170	140	235	182	40	22
	FSA 3	720	109	109	313	288	92
	FSA 5	140	235	114	163	52	32
Landfarm	LFA 1	735	1029	1096	953	157	16
	LFA 3	778	1197	736	904	208	23
	LFA 5	982	814	1135	977	131	13
Processing Facility	PFA 1	2145	1753	1414	1771	299	17
	PFA 2	1696	1219	1982	1632	315	19
	PFA 3	1032	1601	1326	1320	232	18
Lagoon South	LAS SM2	990	888	980	953	46	5
	LAS LM1	1002	1039	672	904	165	18
	LAS LM2A	613	1059	749	807	187	23
	LAS LM2B	664	1379	1445	1163	571	49
	LAS LM2C	582	623	648	618	27	4

[a] Coefficient of variation or relative standard deviation.

TABLE A-25. WET/DRY WEATHERING (INCLUDING COMPRESSIVE STRENGTH OF WEATHERED CORES) OF TREATED SOILS COLLECTED AS FIELD CORES FROM THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT

		Cumulative Corrected Relative Weight Loss												
Sample Source	Block Number	Cycle 1	Cycle 2	Cycle 3	Cycle 4	Cycle 5	Cycle 6	Cycle 7	Cycle 8	Cycle 9	Cycle 10	Cycle 11	Compressive Strength Weathered (psi)	Compressive Strength Control (psi)
Drum Storage DSA	DSA-1	−0.00049	−0.00028	−0.00010	−0.00028	−0.00001	0.00035	0.00042	0.00062	0.00081	0.00090	0.00115	3010	1560
	DSA-3	0.00046	0.00046	0.00043	0.00062	0.00086	0.00065	0.00076	0.00083	0.00096	0.00121	0.00129	1150	750
	DSA-4	−0.00014	0.00044	0.00072	0.00084	0.00082	0.00091	0.00127	0.00167	0.00255	0.00270	0.00258	790	1300
Lagoon North LAN	LAN-1	−0.00043	−0.00123	−0.00105	−0.00121	−0.00100	−0.00080	−0.00024	−0.00027	0.00002	0.00002	−0.00036	180	610
	LAN-4	0.00117	0.00132	0.00148	0.00150	0.00157	0.00119	0.00116	0.00121	0.00118	0.00114	0.00103	540	1660
	LAN-5	−0.00027	−0.00020	0.00027	−0.00043	−0.00060	−0.00063	−0.00050	−0.00037	−0.00047	−0.00049	−0.00044	1100	850
Filter Sludge FSA	FSA-1	0.00015	−0.00015	−0.00030	−0.00030	−0.00037	−0.00044	−0.00050	−0.00072	−0.00086	−0.00094	−0.00087	340	330
	FSA-3	0.00049	0.00178	0.00146	0.00135	0.00061	0.00039	0.00059	0.00049	0.00018	−0.00024	−0.00024	160	260
	FSA-5	0.00083	0.00088	0.00072	0.00071	0.00106	0.00128	0.00130	0.00155	0.00155	0.00132	0.00109	140	620
Landfarm LFA	LFA-1	−0.00070	0.00008	0.00015	0.00060	0.00062	0.00041	0.00063	0.00089	0.00094	0.00116	0.00086	300	100
	LFA-3	0.00005	0.00049	0.00094	0.00139	0.00168	0.00191	0.00253	0.00287	0.00321	0.00333	0.00361	570	1110
	LFA-5	0.00019	0.00043	0.00110	0.00139	0.00155	0.00163	0.00207	0.00253	0.00286	0.00344	0.00383	1230	500
Processing Facility PFA	PFA-1	−0.00021	−0.00025	−0.00035	−0.00035	−0.00012	−0.00004	0.00004	0.00053	0.00078	0.00079	0.00066	1720	1370
	PFA-2	0.00031	0.00019	0.00022	0.00025	0.00014	0.00008	0.00000	0.00018	0.00040	0.00062	0.00107	1690	1660
	PFA-3	0.00037	0.00058	0.00076	0.00098	0.00116	0.00139	0.00142	0.00145	0.00161	0.00168	0.00175	1170	1190
Lagoon South LAS	LAS-S2	0.00081	0.00087	0.00107	0.00097	0.00094	0.00097	0.00083	0.00081	0.00104	0.00115	0.00106	1330	1370
	LAS-L1	0.00096	0.00115	0.00120	0.00138	0.00182	0.00178	0.00207	0.00236	0.00242	0.00292	0.00342	400	450
	LAS-L2A	0.00056	0.00062	0.00096	0.00095	0.00096	0.00118	0.00136	0.00173	0.00172	0.00241	0.00255	620	310
	LAS-L2C	−0.00145	−0.00212	−0.00448	−0.00452	−0.00472	−0.00467	−0.00490	−0.00489	−0.00506	−0.00509	−0.00499	130	420

TABLE A-26. FREEZE/THAW WEATHERING (INCLUDING COMPRESSIVE STRENGTH OF WEATHERED CORES) OF TREATED SOILS COLLECTED AS FIELD CORES FROM THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT

		Cumulative Corrected Relative Weight Loss												
Sample Source	Block Number	Cycle 1	Cycle 2	Cycle 3	Cycle 4	Cycle 5	Cycle 6	Cycle 7	Cycle 8	Cycle 9	Cycle 10	Cycle 11	Compressive Strength Weathered (psi)	Compressive Strength Control (psi)
Drum Storage DSA	DSA-1	0.00008	0.00041	0.00061	0.00066	0.00093	0.00126	0.00133	0.00171	0.00179	0.00187	0.00200	2100	1230
	DSA-3	0.00045	0.00045	0.00053	0.00063	0.00092	0.00155	0.00224	0.00247	0.00320	0.00381	0.00429	660	1020
	DSA-4	-0.00066	-0.00077	-0.00105	-0.00115	-0.00265	-0.00345	-0.00397	-0.00444	-0.00503	-0.00567	-0.00599	1300	210
Lagoon North LAN	LAN-1	0.00073	0.00115	0.00149	0.00195	0.00207	0.00283	0.00336	0.00382	0.00471	0.00524	0.00611	370	250
	LAN-4	-0.00019	0.00000	0.00042	0.00129	0.00203	0.00331	0.00417	0.00575	0.00650	0.00822	0.00938	230	180
	LAN-5	0.00018	0.00036	0.00127	0.00206	0.00253	0.00301	0.00423	0.00533	0.00580	0.00608	0.00649	850	540
Filter Sludge FSA	FSA-1	0.00014	0.00074	0.00073	0.00162	0.00192	0.00221	0.00250	0.00248	0.00293	0.00277	0.00275	400	210
	FSA-3	0.00003	0.00143	0.00092	0.00101	0.00110	0.00178	0.00187	0.00244	0.00253	0.00261	0.00247	150	170
	FSA-5	-0.00006	0.00034	0.00047	0.00047	0.00106	0.00122	0.00153	0.00161	0.00171	0.00177	0.00176	180	160
Landfarm LFA	LFA-1	-0.00053	-0.00028	0.00002	0.00026	0.00035	0.00095	0.00148	0.00160	0.00195	0.00219	0.00281	820	380
	LFA-3	0.00014	0.00064	0.00144	0.00311	0.00377	0.00380	0.00390	0.00412	0.00458	0.00504	0.00526	370	590
	LFA-5	-0.00030	-0.00042	0.00015	0.00070	0.00136	0.00211	0.00329	0.00381	0.00477	0.00606	0.00701	520	320
Processing Facility PFA	PFA-1	0.00031	0.00041	0.00096	0.00108	0.00111	0.00127	0.00138	0.00148	0.00176	0.00190	0.00218	2180	130
	PFA-2	0.00025	0.00030	0.00009	0.00004	0.00014	0.00004	0.00019	0.00055	0.00060	0.00070	0.00091	1540	770
	PFA-3	-0.00038	-0.00060	-0.00031	-0.00009	0.00001	-0.00017	-0.00020	0.00013	0.00042	0.00095	0.00110	980	350
Lagoon South LAS	LAS-S2	0.00017	-0.00018	-0.00053	-0.00092	-0.00143	-0.00139	-0.00129	-0.00118	-0.00101	-0.00083	-0.00065	440	590
	LAS-L1	-0.00010	-0.00032	-0.00027	-0.00040	-0.00048	-0.00018	0.00007	0.00026	0.00057	0.00089	0.00139	210	400
	LAS-L2A	0.00166	0.00281	0.00289	0.00304	0.00308	0.00326	0.00343	0.00349	0.00366	0.00385	0.00397	580	140
	LAS-L2C	-0.00001	-0.00025	-0.00046	-0.00061	-0.00014	0.00006	0.00012	0.00036	0.00010	0.00043	0.00070	360	190

TABLE A-27. VOLATILE ORGANIC COMPOUND CONCENTRATIONS IN TREATED SOILS COLLECTED AS FIELD CORES FROM THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT

Sample Source	Core Designation	(All Concentrations in μg/kg)											
		1	2	3	4	5	6	7	8	9	10	11	12
Drum Storage DSA	DSA 1	<50	<50	<80	<80	890	5500	<30	<30	<30	<30	<30	<30
	DSA 3	<50	<50	<80	<80	100	<600	<30	<30	<30	<30	<30	<30
	DSA 4	<50	<50	<80	<80	140	<600	<30	<30	<30	<30	<30	<30
Lagoon North LAN	LAN 1	<50	<50	<80	<80	430	1800	<30	<30	<30	<30	<30	<30
	LAN 4	<50	<50	<80	<80	280	5400	<30	<30	<30	<30	<30	<30
	LAN 5	<50	<50	<80	<80	390	2200	<30	<30	<30	<30	<30	<30
Filter Sludge FSA	FSA 1	<50	<50	<80	<80	1300	9100	<30	<30	<30	<30	<30	150
	FSA 3	<50	<50	<80	<80	1000	4500	<30	<30	<30	<30	<30	72[a]
	FSA 5	<50	<50	<80	<80	1200	12000	<30	<30	<30	<30	<30	<30
Landfarm LFA	LFA 1	<50	<50	<80	<80	260	3300	<30	<30	<30	<30	<30	<30
	LFA 3	<50	<50	<80	<80	260	2400	<30	<30	<30	<30	<30	<30
	LFA 5	<50	<50	<80	<80	250	2100	<30	<30	<30	<30	<30	<30
Processing Facility PFA	PFA 1	<50	<50	<80	<80	760	<600	<30	<30	<30	<30	<30	<30
	PFA 2	<50	<50	<80	<80	890	8100	<30	<30	<30	<30	<30	<30
	PFA 3	<50	<50	<80	<80	400	<650	<30	<30	<30	<30	<30	<30
Lagoon South LAS	LAS SM2	<50	<50	<80	<80	180	<600	<30	<30	<30	<30	<30	<30
	LAS LM1	<50	<50	<80	<80	320	2100	<30	<30	<30	<30	<30	<30
	LAS LM2A	<50	<50	<80	<80	300	3300	<30	<30	<30	<30	<30	<30
	LAS LM2B	<50	<50	<80	<80	290	2500	<30	<30	<30	<30	<30	<30
	LAS LM2C	<50	<50	<80	<80	250	3000	<30	<30	<30	<30	<30	<30

[a] Value less than three times minimum detection limit.

(Continued)

TABLE A-27. (Continued)

Sample Source	Core Designation	(All Concentrations in μg/kg) 13	14	15	16	17	18	19	20	21	22	23	24
Drum Storage	DSA 1	<30	<300	<30	<30	<30	<30	<30	<30	<30	<30	<30	210
DSA	DSA 3	<30	<300	<30	<30	<30	<30	<30	<30	<30	<30	<30	<50
	DSA 4	<30	<300	<30	<30	<30	<30	<30	<30	<30	<30	<30	<50
Lagoon North	LAN 1	<30	<300	<30	<30	<30	<30	<30	<30	74[a]	<30	<30	<50
LAN	LAN 4	<30	<300	<30	<30	<30	<30	<30	<30	120	<30	<30	<50
	LAN 5	<30	<300	<30	<30	<30	<30	<30	<30	<30	<30	<30	<50
Filter Sludge	FSA 1	280	5600	830	<30	<30	<30	<30	<30	8700	<30	<30	1300
FSA	FSA 3	150	1700	470	<30	<30	<30	<30	<30	4900	<30	<30	530
	FSA 5	<30	3600	610	<30	<30	<30	<30	<30	11000	<30	<30	1200
Landfarm	LFA 1	<30	<300	<30	<30	<30	<30	<30	<30	<30	<30	<30	<50
LFA	LFA 3	<30	<300	<30	<30	<30	<30	<30	<30	<30	<30	<30	<50
	LFA 5	<30	<300	<30	<30	<30	<30	<30	<30	<30	<30	<30	<50
Processing	PFA 1	300	<300	<30	<30	<30	<30	<30	<30	<30	<30	<30	<50
Facility	PFA 2	<30	<300	<30	<30	<30	<30	<30	<30	<30	<30	<30	<50
PFA	PFA 3	<30	<300	<30	<30	<30	<30	<30	<30	<30	<30	<30	<50
Lagoon South	LAS SM2	<30	<300	<30	<30	<30	<30	<30	<30	130	<30	<30	<50
LAS	LAS LM1	<30	<300	<30	<30	<30	<30	<30	<30	180	<30	<30	<50
	LAS LM2A	<30	<300	<30	<30	<30	<30	<30	<30	230	<30	<30	<50
	LAS LM2B	<30	<300	<30	<30	<30	<30	<30	<30	240	<30	<30	<50
	LAS LM2C	<30	<300	<30	<30	<30	<30	<30	<30	95	<30	<30	<50

[a] Value less than three times minimum detection limit.

(Continued)

TABLE A-27. (Continued)

Sample Source	Mold Designation	(All Concentrations in μg/kg)											
		25	26	27	28	29	30	31	32	33	34	35	36
Drum Storage DSA	DSA 1	<30	<30	<30	<30	<30	<30	<30	31000	<30	170	<30	860
	DSA 3	<30	<30	<30	<30	<30	<30	<30	4500	<30	<3	<30	850
	DSA 4	<30	<30	<30	<30	<30	<30	<30	1600	60[a]	78	<30	570
Lagoon North LAN	LAN 1	<30	<30	<30	<30	<30	92	<30	1500	65[a]	220	<30	1600
	LAN 4	<30	<30	<30	<30	<30	140	<30	940	<30	270	<30	2000
	LAN 5	<30	<30	<30	<30	<30	<30	<30	1400	<30	200	<30	2100
Filter Sludge FSA	FSA 1	<30	<30	<30	<30	<30	5000	<30	22000	300	13000	<30	60000
	FSA 3	<30	<30	<30	<30	<30	3400	<30	14000	220	8900	<30	43000
	FSA 5	<30	<30	<30	<30	<30	6100	<30	21000	240	16000	<30	79000
Landfarm LFA	LFA 1	<30	<30	<30	<30	<30	<30	<30	23000	<30	120	<30	870
	LFA 3	<30	<30	<30	<30	<30	43[a]	<30	25000	65[a]	130	<30	810
	LFA 5	<30	<30	<30	<30	<30	<30	<30	23000	<30	130	<30	930
Processing Facility PFA	PFA 1	<30	<30	<30	<30	<30	<30	<30	22000	<30	640	<30	6800
	PFA 2	<30	<30	<30	<30	<30	230	<30	20000	<30	500	<30	3800
	PFA 3	<30	<30	<30	<30	<30	150	<30	11000	<30	400	<30	2800
Lagoon South LAS	LAS SM2	<30	<30	<30	<30	<30	840	<30	500	<30	170	<30	1400
	LAS LM1	<30	<30	<30	<30	<30	1000	<30	1900	<30	340	<30	3000
	LAS LM2A	<30	<30	<30	<30	<30	1300	<30	1400	100	710	<30	5900
	LAS LM2B	<30	<30	<30	<30	<30	1500	<30	2100	<30	520	<30	4600
	LAS LM2C	<30	<30	<30	<30	<30	1000	<30	1200	<30	380	<30	3600

[a] Value less than three times minimum detection limit.

(Continued)

TABLE A-27. (Continued)

Key to VOCs

1. chloromethane
2. bromomethane
3. vinyl chloride
4. chloroethane
5. methylene chloride
6. acetone
7. carbon disulfide
8. trichlorofluoromethane
9. 1,1-dichloroethene
10. 1,1-dichloroethane
11. trans-1,2-dichloroethene
12. chloroform
13. 1,2-dichloroethane
14. 2-butanone
15. 1,1,1-trichloroethane
16. carbon tetrachloride
17. vinyl acetate
18. bromodichloromethane
19. 1,2-dichloropropane
20. cis-1,3-dichloropropene
21. trichloroethene
22. dibromochloromethane
23. 1,1,2-trichloroethane
24. benzene
25. trans-1,3-dichloropropene
26. 2-chloroethylvinyl ether
27. bromoform
28. 2-hexanone
29. 4-methyl-2-pentanone
30. tetrachloroethene
31. 1,1,2,2-tetrachloroethane
32. toluene
33. chlorobenzene
34. ethylbenzene
35. styrene
36. total xylenes

TABLE A-28. BASE-NEUTRAL-ACID (BNA) SEMI-VOLATILE ORGANIC COMPOUND CONCENTRATIONS IN TREATED SOILS COLLECTED AS FIELD CORES FROM THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT

		(All Concentrations in µg/L)								
Sample Type	Core Designation	1	2	3	4	5[a]	6	7	8	9
Drum Storage	DSA 1	<660	<660	<660	<660	<660	<660	<660	<660	<660
	DSA 3	<660	<660	<660	<660	<660	<660	<660	<660	<660
	DSA 4	<660	<660	<660	<660	<660	<660	<660	<660	<660
Lagoon North	LAN 1	<800[b]	<660	<660	700[b]	<660	2300	<660	<660	<660
	LAN 4	<660	<660	<660	1300[b]	<660	2400	<660	<660	<660
	LAN 5	<660	<660	<660	1100[b]	<660	2100	<660	<660	<660
Filter Sludge	FSA 1	<660	<660	<660	1800[b]	<660	9900	1000[b]	2100[b]	2100
	FSA 3	<660	<660	1700[b]	1800[b]	<660	8400	840[b]	1800[b]	1800[b]
	FSA 5	<660	<660	<660	1800[b]	3100	8900	920[b]	<660	<660
Landfarm	LFA 1	<660	<660	<660	<660	<660	<660	<660	<660	<660
	LFA 3	<660	<660	<660	<660	<660	<660	<660	<660	<660
	LFA 5	<660	<660	<660	<660	<660	<660	<660	<660	<660
Processing Facility	PFA 1	<660	<660	<660	<660	<660	<660	<660	<660	<660
	PFA 2	<660	<660	<660	<660	<660	1000[b]	<660	<660	<660
	PFA 3	<660	<660	<660	<660	<660	<660	<660	<660	<660
Lagoon South	LAS SM2	<660	<660	<660	<660	<660	<660	<660	1700[b]	1700[b]
	LAS LM1	<660	<660	800[b]	<660	<660	<660	<660	2700	2700
	LAS LM2A	<660	<660	<660	<660	<660	680[b]	<660	2200	2200
	LAS LM2B									
	LAS LM2C	<660	<660	<660	<660	<660	<660	<660	2000	2000

[a] Laboratory contaminant.

[b] Value less than five times the detection limit.

(Continued)

TABLE A-28. (Continued)

Sample Type	Core Designation	(All Concentrations in μg/L) 10	11	12	13	14	15	16	17
Drum Storage	DSA 1	<660	<660	<660	<660	<660	<660	<660	<660
	DSA 3	<660	<660	<660	<660	<660	<660	<660	<660
	DSA 4	<660	<660	<660	<660	<660	<660	<660	<660
Lagoon North	LAN 1	4200	<660	<660	6700	3600	60000	4500	<660
	LAN 4	3500	<660	<660	5300	3100	4900	3200	<660
	LAN 5	3600	<660	<660	1000	670	12000	2800	<660
Filter Sludge	FSA 1	1500	9300	1700	41000	62000	65000	410000	<660
	FSA 3	2200	7100	9900	10000	16000	41000	110000	<660
	FSA 5	2900	7100	15000	18000	29000	72000	130000	3100
Landfarm	LFA 1	<660	<660	<660	<660	<660	1000	<660	<660
	LFA 3	<660	<660	<660	<660	<660	<660	<660	<660
	LFA 5	<660	<660	<660	<660	<660	<660	1200[b]	<660
Processing Facility	PFA 1	<660	790	<660	<660	<660	<660	3800	<660
	PFA 2	<660	830[a]	<660	<660	<660	<660	5600	<660
	PFA 3	<660	<660	<660	<660	<660	<660	3000	<660
Lagoon South	LAS SM2	<660	<660	<660	710[b]	700[b]	<660	2600	<660
	LAS LM1	870	<660	<660	1000[b]	1400	5100	3400	<660
	LAS LM2A	710[b]	<660	<660	2300	1600	6100	6300	<660
	LAS LM2B								
	LAS LM2C	<660	<660	<660	1500[b]	1300[b]	1800[b]	4900	<660

[a] Laboratory contaminant.

[b] Value less than five times the detection.

(Continued)

TABLE A-28. (Continued)

Key to BNAs

1. dimethyl phthalate
2. fluorene
3. di-n-butyl phthalate
4. fluoranthene
5. n-nitrosodiphenylamine
6. phenanthrene
7. benzo(a)anthracene
8. bis(2-ethylhexyl)phthalate
9. chrysene
10. pyrene
11. 1,2-dichlorobenzene
12. 2-methylphenol
13. 4-methylphenol
14. phenol
15. 2,4-dimethylphenol
16. naphthalene
17. benzo(a)pyrene

(Continued)

TABLE A-28. (Continued)

BNA Compounds Not Detected			
Compound	Detection Limit	Compound	Detection Limit
acenaphthene	10	aniline	660
acenaphthylene	10	benzyl alcohol	1300
1-chloronaphthalene	10	bis(2-chloroethyl)ether	660
2-chloronaphthalene	10	bis(2-chloroisopropyl)ether	660
4-chlorophenyl phenyl ether	10	2-chlorophenol	660
dibenzofuran	10	1,3-dichlorobenzene	660
diethyl phthalate	660	1,4-dichlorobenzene	660
2,4-dinitrophenol	10	ethyl methanesulfonate	660
2,4-dinitrotoluene	50	hexachloroethane	660
2,6-dinitrotoluene	10	methyl methanesulfonate	660
hexachlorocyclopentadiene	10	n-nitrosodimethylamine	660
1-naphthylamine	10	n-nitroso-di-n-propylamine	660
2-naphthylamine	10	2-picoline	660
2-nitroaniline	50	acetophenone	660
3-nitroaniline	50	benzoic acid	660
4-nitroaniline	50	bis(2-chloroethoxy)methane	660
4-nitrophenol	50	4-chloroaniline	1300
pentachlorobenzene	10	4-chloro-3-methylphenol	1300
1,2,4,5-tetrachlorobenzene	10	2,4-dichlorophenol	660
2,3,4,6-tetrachlorophenol	10	2,6-dichlorophenol	660
2,4,6-trichlorophenol	10	a,a-dimethyl-phenethylamine	660
2,4,5-trichlorophenol	10	hexachlorobutadiene	660
4-aminobiphenyl	10	isophorone	660
anthracene	660	2-methylnaphthalene	660
4-bromophenyl phenyl ether	10	nitrobenzene	660
4,6-dinitro-2-methylphenol	50	2-nitrophenol	660
diphenylamine	660	n-nitroso-di-n-butylamine	660
1,2-diphenylhydrazine	10	n-nitrosopiperidine	660
hexachlorobenzene	10	1,2,4-trichlorobenzene	660
pentachlorophenol	3300	benzo(b)fluoroanthene	660
pentachloronitrobenzene	10	benzo(k)fluoranthene	660
phenacetin	10	benzo(g,h,i)perylene	660
pronamide	660	dibenz(a,j)acridine	660
benzidine	10	dibenz(a,h)anthracene	660
butylbenzylphthalate	660	12-dimethylbenz(a)anthracene	660
3,3'-dichlorobenzidine	660	di-n-octylphthalate	660
p-dimethylaminoazobenzene	20	indeno(1,2,3-cd)pyrene	660
		3-methylchloanthene	660

TABLE A-29. PRIORITY POLLUTANT METALS CONCENTRATIONS IN TREATED SOILS COLLECTED AS FIELD CORES FROM THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT

Sample Type	Core Designation	(All concentrations in mg/kg)					
		Cadmium	Chromium	Copper	Lead	Nickel	Zinc
Blank	--	<1	<2	<7	<20	<5	<1
Drum Storage DSA	DSA 1	<3	22	<20	1170	29	130
	DSA 3	<3	31	<20	570	<20	66
	DSA 4	<3	30	<20	740	<20	95
Lagoon North LAN	LAN 1	<3	25	<20	3010	<20	70
	LAN 4	<3	25	<20	2600	<20	70
	LAN 5	<3	24	<20	2850	<20	63
Filter Sludge FSA	FSA 1	<3	27	69	10200	<20	280
	FSA 3	<3	26	56	8900	<20	220
	FSA 5	<3	29	75	11700	<20	350
Landfarm LFA	LFA 1	<3	29	<30	2700	<20	210
	LFA 3	<3	31	<20	1040	<20	81
	LFA 5	<3	26	<20	1850	<20	150
Processing Facility PFA	PFA 1	<3	36	33	740	<20	125
	PFA 2	<3	44	110	4200	24	410
	PFA 3	<3	44	130	4900	<20	510
Lagoon South LAS	LAS SM2	<3	31	34	2400	<20	170
	LAS LM1	<3	44	50	3850	<20	230
	LAS LM2A	<3	20	40	2150	<20	210
	LAS LM2C	<3	50	52	4400	<20	230

TABLE A-30. OIL AND GREASE CONCENTRATIONS IN TREATED SOILS COLLECTED AS FIELD CORES FROM THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT

Sample Type	Core Designation	Oil & Grease in Core (mg/kg)
Drum Storage	DSA1	7,900
	DSA3	4,000
	DSA4	4,300
Lagoon North	LAN1	82,300
	LAN4	77,800
	LAN5	66,100
Filter Sludge	FSA1	90,100
	FSA3	87,500
	FSA5	106,000
Landfarm	LFA1	18,000
	LFA3	13,000
	LFA5	15,000
Processing Facility	PFA1	20,000
	PFA2	14,300
	PFA3	29,000
Lagoon South	LAS SM2	21,500
	LAS LM1	600
	LAS LM2A	42,500
	LAS LM2B	--
	LAS LM2C	2,300

TABLE A-31. PRIORITY POLLUTANT METALS CONCENTRATIONS IN EP EXTRACTS OF TREATED SOILS COLLECTED AS FIELD CORES FROM THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT

Sample Type	Core Designation	Test Status	(All Concentrations in mg/L)					
			Cadmium	Chromium	Copper	Lead	Nickel	Zinc
Lagoon North LAN	LAN 1	Test	<0.002	<0.006	<0.03	0.017	0.017	<0.002
	LAN 4	Test	<0.002	<0.006	<0.03	0.036	0.020	0.003[a]
	LAN 5	Test	<0.002	<0.006	<0.03	0.07	0.007[a]	<0.002
Filter Sludge FSA	FSA 1	Test	<0.002	0.016[a]	<0.03	0.27	<0.006	0.008
	FSA 3	Test	<0.002	<0.006	<0.03	0.26	<0.006	<0.002
	FSA 5	Test	<0.002	0.019	<0.04	0.11	<0.006	<0.002

[a] Less than three times the minimum detection limit.

TABLE A-32. POLYCHLORINATED BIPHENYLS (PCBs) CONCENTRATIONS IN TCLP EXTRACTS OF TREATED SOILS COLLECTED AS FIELD CORES FROM THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT ESTIMATED BY GAS CHROMATOGRAPHY METHOD 8080

Sample Type	Core Designation	PCBs by GC
Drum Storage	DSA 1	NP[a]
	DSA 3	NP
	DSA 4	NP
Lagoon North	LAN 1	680 HA[b]
	LAN 4	680 HA
	LAN 5	680 HA
Filter Sludge	FSA 1	680 HA
	FSA 3	680 HA
	FSA 5	680 HA
Landfarm	LFA 1	B 680[c]
	LFA 3	NP
	LFA 5	B 680
Processing Facility	PFA 1	B 680
	PFA 2	680 HB[d]
	PFA 3	680 HB
Lagoon South	LAS SM2	680 HB
	LAS LM1	680 HB
	LAS LM2A	680 HB
	LAS LM2B	--
	LAS LM2C	680 HB

[a] No discernible peaks.
[b] Candidate for 680 test; high level Group A.
[c] Peaks detected, but below 680 method detection limit
[d] Candidate for 680 test; high level, Group B

TABLE A-33. POLYCHLORINATED BIPHENYLS (PCBs) CONCENTRATIONS IN TCLP EXTRACTS OF TREATED SOILS COLLECTED AS FIELD CORES FROM THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT ESTIMATED BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY METHOD 680

Sample Source	Core Designation	(All Concentrations in μg/L) Monochloro-Biphenyl	Dichloro-Biphenyl	Trichloro-Biphenyl	Tetrachloro-Biphenyl	Penta Biphenyl	Hexa Biphenyl	Hepta Biphenyl	Octa Biphenyl	Nona Biphenyl	Deca Biphenyl
Background Soil		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Background Soil 2		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Drum Storage	DSA 1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
DSA	DSA 3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	DSA 4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lagoon North	LAN 1	<0.05	<0.07	<0.07	<0.12	<0.10	<0.12	<0.18	<0.35	<0.30	<0.33
LAN	LAN 4	<0.05	<0.07	<0.07	<0.12	<0.10	<0.12	<0.18	<0.35	<0.30	<0.33
	LAN 5	<0.05	<0.07	<0.07	<0.12	<0.10	<0.12	<0.18	<0.35	<0.30	<0.33
Filter Sludge	FSA 1	<0.05	<0.07	<0.07	<0.12	<0.10	<0.12	<0.18	<0.35	<0.30	<0.33
FSA	FSA 3	<0.05	<0.07	<0.07	<0.12	<0.10	<0.12	<0.18	<0.35	<0.30	<0.33
	FSA 5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Landfarm	LFA 1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
LFA	LFA 3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	LFA 5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Processing	PFA 1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Facility	PFA 2	<0.5	<0.7	<0.7	<1.2	<1.0	<1.2	<1.8	<3.5	<3.0	<3.3
PFA	PFA 3	<0.5	<0.7	<0.7	<1.2	<1.0	<1.2	<1.8	<3.5	<3.0	<3.3
Lagoon South	LAS SM2	<0.5	<0.7	<0.7	<1.2	<1.0	<1.2	<1.8	<3.5	<3.0	<3.3
LAS	LAS LM1	<0.05	<0.07	<0.07	<0.12	<0.10	<0.12	<0.18	<0.35	<0.30	<0.33
	LAS LM2A	<0.05	<0.07	<0.07	<0.12	<0.10	<0.12	<0.18	<0.35	<0.30	<0.33
	LAS LM2B	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	LAS LM2C	<0.05	<0.07	<0.07	<0.12	<0.10	<0.12	<0.18	<0.35	<0.30	<0.33

[a] Not analyzed.

TABLE A-34. VOLATILE ORGANIC COMPOUND CONCENTRATIONS IN TCLP EXTRACTS OF TREATED SOILS COLLECTED AS FIELD CORES FROM THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT

Sample Source	Core Designation	(All Concentrations in µg/L) 1	2	3	4	5	6	7	8	9	10	11	12
Drum Storage DSA	DSA 1	<20	<10	<20	<20	20[a]	<900	<7	<5	<8	<8	<10	<6
	DSA 3	<20	<10	<20	<20	20[a]	<900	<7	<5	<8	<8	<10	<6
	DSA 4	<20	<10	<20	<20	10[a]	90[a]	<7	<5	<8	<8	<10	<6
Lagoon North LAN	LAN 1	<20	<10	<20	<20	7[a]	100[a]	<7	<5	<8	<8	<10	4[a]
	LAN 4	<20	<10	<20	<20	7[a]	200[a]	<7	<5	<8	<8	<10	<6
	LAN 5	<20	<10	<20	<20	6[a]	600[a]	<7	<5	<8	<8	<10	<6
Filter Sludge FSA	FSA 1	<20	<10	<20	1[a]	20[a]	1000[a]	<7	<5	<8	<8	<10	2[a]
	FSA 3	<20	<10	<20	<20	60	400[a]	<7	<5	<8	<8	<10	3[a]
	FSA 5	<20	<10	<20	<20	40	800[a]	<7	<5	<8	<8	<10	2[a]
Landfarm LFA	LFA 1	<20	<10	<20	<20	8[a]	80[a]	<7	<5	<8	<8	<10	<6
	LFA 3	<20	<10	<20	<20	3[a]	200[a]	<7	<5	<8	<8	<10	2[a]
	LFA 5	<20	<10	<20	<20	4[a]	100[a]	<7	<5	<8	<8	<10	2[a]
Processing Facility PFA	PFA 1	<20	<10	<20	<20	20[a]	900	<7	<5	<8	<8	<10	<6
	PFA 2	<20	<10	<20	<20	30	900	<7	<5	<8	<8	<10	<6
	PFA 3	<20	<10	<20	<20	20[a]	<900	<7	<5	<8	<8	<10	<6
Lagoon South LAS	LAS SM2	<20	<10	<20	<20	7[a]	100[a]	<7	<5	<8	<8	<10	5[a]
	LAS LM1	<20	<10	<20	<20	4[a]	400[a]	<7	<5	<8	<8	<10	2[a]
	LAS LM2A	<20	<10	<20	<20	5[a]	200[a]	<7	<5	<8	<8	<10	2[a]
	LAS LM2B	<20	<10	<20	<20	10[a]	100[a]	<7	<5	<8	<8	<10	<6
	LAS LM2C	<20	<10	<20	<20	6[a]	80[a]	<7	<5	<8	<8	<10	1[a]

[a] Value less than three times minimum detection limit.

(Continued)

TABLE A-34. (Continued)

Sample Source	Core Designation	(All Concentrations in μg/L)											
		13	14	15	16	17	18	19	20	21	22	23	24
Drum Storage DSA	DSA 1	<7	<300	<6	<7	<10	<6	<10	<20	<9	<5	<10	<6
	DSA 3	<7	<300	<6	<7	<10	<6	<10	<20	<9	<5	<10	<6
	DSA 4	<7	<300	<6	<7	<10	<6	<10	<20	<9	<5	<10	<6
Lagoon North LAN	LAN 1	<7	30[a]	<6	<7	<10	<6	<10	<20	1[a]	<5	<10	<6
	LAN 4	<7	60[a]	<6	<7	<10	<6	<10	<20	2[a]	<5	<10	<6
	LAN 5	<7	40[a]	<6	<7	<10	<6	<10	<20	1[a]	<5	<10	<6
Filter Sludge FSA	FSA 1	7[a]	200[a]	9[a]	1[a]	<10	<6	2[a]	<20	90	<5	<10	20
	FSA 3	<7	100[a]	10[a]	<7	<10	<6	<10	<20	100	<5	<10	30
	FSA 5	<7	200[a]	10[a]	<7	<10	<6	<10	<20	100	<5	<10	40
Landfarm LFA	LFA 1	<7	<300	<6	<7	<10	<6	<10	<20	<9	<5	<10	<6
	LFA 3	<7	<300	<6	<7	<10	<6	<10	<20	<9	<5	<10	<6
	LFA 5	<7	20[a]	<6	<7	<10	<6	<10	<20	<9	<5	<10	<6
Processing Facility PFA	PFA 1	<7	<300	<6	<7	<10	<6	<10	<20	<9	<5	<10	<6
	PFA 2	<7	<300	<6	<7	<10	<6	<10	<20	<9	<5	<10	<6
	PFA 3	<7	<300	<6	<7	<10	<6	<10	<20	<9	<5	<10	<6
Lagoon South LAS	LAS SM2	<7	40[a]	3[a]	<7	<10	<6	<10	<20	10[a]	<5	<10	1[a]
	LAS LM1	<7	30[a]	<6	<7	<10	<6	<10	<20	6[a]	<5	<10	<6
	LAS LM2A	<7	40[a]	<6	<7	<10	<6	<10	<20	5[a]	<5	<10	<6
	LAS LM2B	<7	<300	<6	<7	<10	<6	<10	<20	9[a]	<5	<10	<6
	LAS LM2C	<7	23[a]	<6	<7	<10	<6	<10	<20	6[a]	<5	<10	<6

[a] Value less than three times minimum detection limit.

(Continued)

TABLE A-34. (Continued)

Sample Source	Mold Designation	(All Concentrations in μg/L)											
		25	26	27	28	29	30	31	32	33	34	35	36
Drum Storage DSA	DSA 1	<8	<30	<7	<40	<30	<6	<6	200	9[a]	<3	<40	5[a]
	DSA 3	<8	<30	<7	<40	<30	<6	<6	400	<4	<3	<40	10[a]
	DSA 4	<8	<30	<7	<40	<30	<6	<6	500	2[a]	1[a]	3[a]	4[a]
Lagoon North LAN	LAN 1	<8	<30	<7	<40	<30	3[a]	<6	40	1[a]	2[a]	2[a]	7[a]
	LAN 4	<8	<30	<7	<40	<30	1[a]	<6	10[a]	1[a]	2[a]	1[a]	10[a]
	LAN 5	<8	<30	<7	<40	<30	4[a]	<6	60	<4	2[a]	1[a]	8[a]
Filter Sludge FSA	FSA 1	<8	<30	<7	30[a]	<30	20	<6	300	1[a]	70	<40	400
	FSA 3	<8	<30	<7	<40	200	20	<6	200	<4	60	<40	300
	FSA 5	<8	<30	<7	<40	400	20	<6	200	<4	60	<40	300
Landfarm LFA	LFA 1	<8	<30	<7	<40	<30	<6	<6	200	<4	<3	<40	<9
	LFA 3	<8	<30	<7	<40	<30	<6	<6	500	<4	2[a]	3[a]	2[a]
	LFA 5	<8	<30	<7	<40	<30	<6	<6	400	<4	1[a]	2[a]	6[a]
Processing Facility PFA	PFA 1	<8	<30	<7	<40	<30	3[a]	<6	400	<4	<3	<40	60
	PFA 2	<8	<30	<7	<40	<30	<6	<6	400	<4	<3	<40	40
	PFA 3	<8	<30	<7.	<40	<30	<6	<6	1200	4[a]	6[a]	<40	400
Lagoon South LAS	LAS SM2	<8	<30	<7	<40	<30	20	<6	50	1[a]	4[a]	3[a]	40
	LAS LM1	<8	<30	<7	<40	<30	8[a]	<6	70	<4	3[a]	2[a]	20[a]
	LAS LM2A	<8	<30	<7	10[a]	9[a]	7[a]	<6	40	<4	6[a]	3[a]	50
	LAS LM2B	<8	<30	<7	<40	<30	10[a]	<6	50	3[a]	5[a]	<40	40
	LAS LM2C	<8	<30	<7	<40	<30	6[a]	<6	40	1[a]	5[a]	<40	40

[a] Value less than three times minimum detection limit.

(Continued)

TABLE A-34. (Continued)

Key to VOCs

1. chloromethane
2. bromomethane
3. vinyl chloride
4. chloroethane
5. methylene chloride
6. acetone
7. carbon disulfide
8. trichlorofluoromethane
9. 1,1-dichloroethene
10. 1,1-dichloroethane
11. trans-1,2-dichloroethene
12. chloroform
13. 1,2-dichloroethane
14. 2-butanone
15. 1,1,1-trichloroethane
16. carbon tetrachloride
17. vinyl acetate
18. bromodichloromethane
19. 1,2-dichloropropane
20. cis-1,3-dichloropropene
21. trichloroethene
22. dibromochloromethane
23. 1,1,2-trichloroethane
24. benzene
25. trans-1,3-dichloropropene
26. 2-chloroethylvinyl ether
27. bromoform
28. 2-hexanone
29. 4-methyl-2-pentanone
30. tetrachloroethene
31. 1,1,2,2-tetrachloroethane
32. toluene
33. chlorobenzene
34. ethylbenzene
35. styrene
36. total xylenes

TABLE A-35. BASE-NEUTRAL-ACID (BNA) SEMI-VOLATILE ORGANIC COMPOUND CONCENTRATIONS IN TCLP EXTRACTS OF TREATED SOILS COLLECTED AS FIELD CORES FROM THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT

Sample Source	Block Designation	Test Status	(All Concentrations in µg/L)									
			1	2	3	4	5	6	7	8	9	10
Drum Storage DSA	DSA 1	Test	<10	<10	<10	<10	<10	<10	<10	14[a]	<10	<10
	DSA 3	Test	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
	DSA 4	Test	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Lagoon North LAN	LAN 1	Test	<10	<10	<10	18[a]	<10	21[a]	460	690	220	<10
	LAN 4	Test	<10	<10	<10	<10	<10	45	120	860	380	<10
	LAN 5	Test	<10	<10	<10	13[a]	<10	27[a]	530	720	250	<10
Filter Sludge FSA	FSA 1	Test	<10	<10	<10	<10	15[a]	580	1400	1500	520	83
	FSA 3	Test	<10	<10	<10	17[a]	12[a]	<10	<10	1000	410	62
	FSA 5	Test	<10	<10	<10	14[a]	<10	450	1100	1200	28[a]	46
Landfarm LFA	LFA 1	Test	<10	<10	<10	23[a]	<10	<10	44	27[a]	<10	<10
	LFA 3	Test	<10	<10	<10	<10	<10	<10	21[a]	19[a]	11[a]	<10
	LFA 5	Test	<10	<10	<10	41	<10	11[a]	49	36	21[a]	11a
Processing Facility PFA	PFA 1	Test	<10	<10	<10	67	<10	<10	27[a]	53	19[a]	13[a]
	PFA 2	Test	<10	<10	<10	19[a]	<10	<10	28[a]	49	19[a]	<10
	PFA 3	Test	<10	<10	<10	11[a]	<10	<10	27[a]	<10	17[a]	<10
Lagoon South LAS	LAS SM2	Test	<10	<10	<10	21[a]	<10	21[a]	180	210	70	<10
	LAS LM1	Test	<10	<10	<10	18[a]	<10	41	240	280	110	<10
	LAS LM2A	Test	<10	<10	<10	24[a]	<10	62	330	350	140	10[a]
	LAS LM2B	Reserve	<10	<10	<10	53	<10	46	290	320	110	<10
	LAS LM2C	Test	<10	<10	<10	290	<10	21[a]	190	220	48	10[a]

[a] Value less than 5 times the detection limit.

Compound No.	Name	Compound No.	Name
1	diethylphthalate	6	2-methylphenol
2	Di n-butyl phthalate	7	4-methylphenol
3	benzo (a) anthracene	8	phenol
4	bis (2-ethylhexyl) phthalate	9	2,4-dimethylphenol
5	1,2-dichlorobenzene	10	naphthalene

TABLE A-35. (Continued)

BNA Compounds Not Detected			
Compound	Detection Limit	Compound	Detection Limit
acenaphthene	10	aniline	660
acenaphthylene	10	benzyl alcohol	1300
1-chloronaphthalene	10	bis(2-chloroethyl)ether	660
2-chloronaphthalene	10	bis(2-chloroisopropyl)ether	660
4-chlorophenyl phenyl ether	10	2-chlorophenol	660
dibenzofuran	10	1,3-dichlorobenzene	660
dimethyl phthalate	660	1,4-dichlorobenzene	660
2,4-dinitrophenol	10	ethyl methanesulfonate	660
2,4-dinitrotoluene	50	hexachloroethane	660
2,6-dinitrotoluene	10	methyl methanesulfonate	660
fluorene	660	n-nitrosodimethylamine	660
hexachlorocyclopentadiene	10	n-nitroso-di-n-propylamine	660
1-naphthylamine	10	2-picoline	660
2-naphthylamine	10	acetophenone	660
2-nitroaniline	50	benzoic acid	660
3-nitroaniline	50	bis(2-chloroethoxy)methane	660
4-nitroaniline	50	4-chloroaniline	1300
4-nitrophenol	50	4-chloro-3-methylphenol	1300
pentachlorobenzene	10	2,4-dichlorophenol	660
1,2,4,5-tetrachlorobenzene	10	2,6-dichlorophenol	660
2,3,4,6-tetrachlorophenol	10	a,a-dimethyl-phenethylamine	660
2,4,6-trichlorophenol	10	hexachlorobutadiene	660
2,4,5-trichlorophenol	10	isophorone	660
4-aminobiphenyl	10	2-methylnaphthalene	660
anthracene	660	nitrobenzene	660
4-bromophenyl phenyl ether	10	2-nitrophenol	660
4,6-dinitro-2-methylphenol	50	n-nitroso-di-n-butylamine	660
diphenylamine	660	n-nitrosopiperidine	660
1,2-diphenylhydrazine	10	1,2,4-trichlorobenzene	660
fluoranthene	660	benzo(b)fluoroanthene	660
hexachlorobenzene	10	benzo(k)fluoranthene	660
n-nitrosodiphenylamine	660	benzo(g,h,i)perylene	660
pentachlorophenol	3300	benzo(a)pyrene	660
pentachloronitrobenzene	10	dibenz(a,j)acridine	660
phenacetin	10	dibenz(a,h)anthracene	660
phenanthrene	660	12-dimethylbenz(a)anthracene	660
pronamide	660	di-n-octylphthalate	660
benzidine	10	indeno(1,2,3-cd)pyrene	660
butylbenzylphthalate	660	3-methylchloanthene	660
chrysene	660		
3,3'-dichlorobenzidine	20		
p-dimethylaminoazobenzene	660		
pyrene	660		

TABLE A-36. PRIORITY POLLUTANT METALS CONCENTRATIONS IN TCLP EXTRACTS OF TREATED SOILS COLLECTED AS FIELD CORES FROM THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT

Sample Type	Core Designation	(All Concentrations in mg/L)					
		Cadmium	Chromium	Copper	Lead	Nickel	Zinc
Blank	--						
Drum Storage DSA	DSA 1	<0.004	<0.007	0.03	0.005	0.02	0.03[a]
	DSA 3	<0.004	0.008	0.02	0.007	0.02	0.03[a]
	DSA 4	<0.004	<0.007	0.02	0.009	0.02	0.05[a]
Lagoon North LAN	LAN 1	<0.004	0.01	0.01	0.007	<0.015	0.04[a]
	LAN 4	<0.004	<0.007	0.01[a]	0.003	<0.015	0.006[a]
	LAN 5	<0.004	0.009	0.01	0.005	<0.015	0.006[a]
Filter Sludge FSA	FSA 1	<0.04	<0.07	<0.06	0.20	<0.15	0.05
	FSA 3	<0.04	<0.07	<0.06	0.95	<0.15	0.06
	FSA 5	<0.04	<0.07	<0.06	0.007	<0.15	<0.02
Landfarm LFA	LFA 1	<0.004	0.01	0.14[a]	0.13	0.02	0.01[a]
	LFA 3	<0.004	0.008	0.05[a]	0.008	0.02	0.02[a]
	LFA 5	<0.004	0.01	0.05[a]	0.011	<0.015	0.01[a]
Processing Facility PFA	PFA 1	<0.004	<0.007	0.02	0.005	<0.015	0.01[a]
	PFA 2	<0.004	<0.007	0.03	0.008	<0.015	0.01[a]
	PFA 3	<0.004	<0.007	0.03	0.02	<0.015	0.07[a]
Lagoon South LAS	LAS SM2	0.007	0.05	0.10[a]	11.0	0.06	0.95[a]
	LAS LM1	<0.004	0.01	0.06[a]	0.003	0.02	0.02[a]
	LAS LM2A	<0.004	<0.007	0.04[a]	0.10	0.02	0.01[a]
	LAS LM2C	<0.004	<0.007	0.02[a]	0.05	<0.015	0.05[a]

TABLE A-37. OIL AND GREASE CONCENTRATIONS IN TCLP EXTRACTS OF TREATED SOILS COLLECTED AS FIELD CORES FROM THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT

Sample Type	Core Designation	Oil & Grease in TCLP (mg/L)
Drum Storage	DSA 1	4.5
	DSA 3	3.7
	DSA 4	4.7
Lagoon North	LAN 1	2.1
	LAN 4	2.1
	LAN 5	2.4
Filter Sludge	FSA 1	8.1
	FSA 3	10.0
	FSA 5	13.0
Landfarm	LFA 1	3.1
	LFA 3	1.0[a]
	LFA 5	1.7
Processing Facility	PFA 1	1.8
	PFA 2	2.8
	PFA 3	5.8
Lagoon South	LAS SM2	2.5
	LAS LM1	2.9
	LAS LM2A	---
	LAS LM2B	<0.2
	LAS LM2C	1.0[a]

[a] Value less than 5 times detection limit.

TABLE A-38. POLYCHLORINATED BIPHENYLS (PCBs) CONCENTRATIONS IN ANS 16.1 EXTRACTS OF TREATED SOILS COLLECTED AS FIELD CORES FROM THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT ESTIMATED BY GAS CHROMATOGRAPHY METHOD 8080

Sample Type	Core Designation	Day 1	Day 3	Day 7	Day 14	Day 28
Lagoon North	LAN 5	B 680[a]	B 680	B 680	680 LA[b]	B 680
Filter Sludge	FSA 1	B 680	NP[c]	B 680	B 680	NP
Processing Facility	PFA 3	NP	NP	NP	B 680	NP
Lagoon South	LAS SM2	B 680	B 680	B 680	B 680	B 680

[a] Peaks detected, but below 680 method detection limit.

[b] Candidate for 680 test; low level, Group A

[c] No discernible peaks.

TABLE A-39. POLYCHLORINATED BIPHENYLS (PCBs) CONCENTRATIONS IN ANS 16.1 EXTRACTS OF TREATED SOILS COLLECTED AS FIELD CORES FROM THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT ESTIMATED BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY METHOD 680

			(All Concentrations in μg/L)									
Sample Source	Core Designation	Day	Monochloro-Biphenyl	Dichloro-Biphenyl	Trichloro-Biphenyl	Tetrachloro-Biphenyl	Penta Biphenyl	Hexa Biphenyl	Hepta Biphenyl	Octa Biphenyl	Nona Biphenyl	Deca Biphenyl
Lagoon North	LAN 5	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		14	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		28	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Filter Sludge	FSA 1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		14	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		28	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Processing Facility	PFA 3	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		14	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		28	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lagoon South	LAS SM2	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		14	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		28	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

[a] NA = Not analyzed.

TABLE A-40. VOLATILE ORGANIC COMPOUND CONCENTRATIONS IN ANS 16.1 EXTRACTS OF TREATED SOILS COLLECTED AS FIELD CORES FROM THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT

Sample Source	Core Designation	Day Number	(All Concentrations in μg/L) 1	2	3	4	5	6	7	8	9	10	11	12
Blank		7	<10	<10	<10	<10	<5	<100	<5	<5	<5	<5	<5	<5
Lagoon North	LAN 5	1	<10	<10	<10	<10	<5	<100	<5	<5	<5	<5	<5	<5
		3	<10	<10	<10	<10	<5	<100	<5	<5	<5	<5	<5	<5
		7	<10	<10	<10	<10	<5	<100	<5	<5	<5	<5	<5	<5
		14	<10	<10	<10	<10	<5	<100	<5	<5	<5	<5	<5	<5
		28	<10	<10	<10	<10	<5	100[a]	<5	<5	<5	<5	<5	<5
Filter Sludge	FSA 1	1	<10	<10	<10	<10	<5	<100	<5	<5	<5	<5	<5	<5
		3	<10	<10	<10	<10	<5	270[a]	<5	<5	<5	<5	<5	<5
		4	<10	<10	<10	<10	<5	<100	<5	<5	<5	<5	<5	<5
		14	<10	<10	<10	<10	24	<100	<5	<5	<5	<5	<5	<5
		28	<10	<10	<10	<10	5[a]	210[a]	<5	<5	<5	<5	<5	<5
Processing Facility	PFA 3	1	<10	<10	<10	<10	<5	<100	<5	<5	<5	<5	<5	<5
		3	<10	<10	<10	<10	<5	<100	<5	<5	<5	<5	<5	<5
		7	<10	<10	<10	<10	<5	<100	<5	<5	<5	<5	<5	<5
		14	<10	<10	<10	<10	<5	<100	<5	<5	<5	<5	<5	<5
		28	<10	<10	<10	<10	<5	<100	<5	<5	<5	<5	<5	<5
Lagoon South	LAS S2	1	<10	<10	<10	<10	<5	<100	<5	<5	<5	<5	<5	<5
		3	<10	<10	<10	<10	<5	<100	<5	<5	<5	<5	<5	<5
		4	<10	<10	<10	<10	<5	<100	<5	<5	<5	<5	<5	<5
		14	<10	<10	<10	<10	<5	<100	<5	<5	<5	<5	<5	<5
		28	<10	<10	<10	<10	<5	62[a]	<5	<5	<5	<5	<5	<5

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[a] Value less than 3 times minimum detection limit.

(Continued)

TABLE A-40. (Continued)

Sample Source	Core Designation	Day Number	(All Concentrations in µg/L) 13	14	15	16	17	18	19	20	21	22	23	24
Blank		7	<5	<100	<5	<5	<50	<5	<5	<5	<5	<5	<5	<5
Lagoon North	LAN 5	1	<5	<100	<5	<5	<50	<5	<5	<5	<5	<5	<5	<5
		3	<5	<100	<5	<5	<50	<5	<5	<5	<5	<5	<5	<5
		7	<5	<100	<5	<5	<50	<5	<5	<5	<5	<5	<5	<5
		14	<5	<100	<5	<5	<50	<5	<5	<5	<5	<5	<5	<5
		28	<5	<60	<5	<5	<50	<5	<5	<5	<5	<5	<5	<5
Filter Sludge	FSA 1	1	<5	<100	5[a]	<5	<50	<5	<5	<5	25	<5	<5	18
		3	<5	<100	8[a]	<5	<50	<5	<5	<5	56	<5	<5	23
		7	<5	<100	<5	<5	<50	<5	<5	<5	41	<5	<5	11[a]
		14	<5	<100	<5	<5	<50	<5	<5	<5	23	<5	<5	7[a]
		28	<5	<60	6[a]	<5	<50	<5	<5	<5	59	<5	<5	18
Processing Facility	PFA 3	1	<5	<100	<5	<5	<50	<5	<5	<5	<5	<5	<5	<5
		3	<5	<100	<5	<5	<50	<5	<5	<5	<5	<5	<5	<5
		7	<5	<100	<5	<5	<50	<5	<5	<5	<5	<5	<5	<5
		14	<5	<100	<5	<5	<50	<5	<5	<5	<5	<5	<5	<5
		28	<5	<60	<5	<5	<50	<5	<5	<5	<5	<5	<5	<5
Lagoon South	LAS S2	1	<5	<100	<5	<5	<50	<5	<5	<5	<5	<5	<5	<5
		3	<5	<100	<5	<5	<50	<5	<5	<5	<5	<5	<5	<5
		7	<5	<100	<5	<5	<50	<5	<5	<5	<5	<5	<5	<5
		14	<5	<100	<5	<5	<50	<5	<5	<5	<5	<5	<5	<5
		28	<5	<60	<5	<5	<50	<5	<5	<5	5[a]	<5	<5	<5

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[a] Value less than 3 times minimum detection limit.

(Continued)

TABLE A-40. (Continued)

Sample Source	Core Designation	Day Number	25	26	27	28	29	30	31	32	33	34	35	36
			(All Concentrations in µg/L)											
Blank		7	<5	<15	<5	<50	<50	<5	<5	<5	<5	<5	<5	<5
Lagoon North	LAN 5	1	<5	<15	<5	<50	<50	<5	<5	<5	<5	<5	<5	<5
		3	<5	<15	<5	<50	<50	<5	<5	<5	<5	<5	<5	<5
		7	<5	<15	<5	<50	<50	<5	<5	<5	<5	<5	<5	<5
		14	<5	<15	<5	<50	<50	<5	<5	<5	<5	<5	<5	<5
		28	<5	<15	<5	<15	<5	<5	<5	10[a]	<5	<5	<5	6[a]
Filter Sludge	FSA 1	1	<5	<15	<5	<50	<50	<5	<5	46	<5	12[a]	<5	63
		3	<5	<15	<5	<50	<50	8[a]	<5	120	<5	31	<5	210
		7	<5	<15	<5	<50	<50	6[a]	<5	81	<5	16	<5	91
		14	<5	<15	<5	<50	<50	<5	<5	46	<5	11[a]	<5	59
		28	<5	<15	<5	<15	<5	9[a]	<5	130	<5	33	<5	180
Processing Facility	PFA 3	1	<5	<15	<5	<50	<50	<5	<5	69	<5	<5	<5	<5
		3	<5	<15	<5	<50	<50	<5	<5	10[a]	<5	<5	<5	<5
		7	<5	<15	<5	<50	<50	<5	<5	41	<5	<5	<5	<5
		14	<5	<15	<5	<50	<50	<5	<5	130	<5	<5	<5	<5
		28	<5	<15	<5	<15	<5	<5	<5	110	<5	<5	<5	5[a]
Lagoon South	LAS S2	1	<5	<15	<5	<50	<50	<5	<5	<5	<5	<5	<5	<5
		3	<5	<15	<5	<50	<50	<5	<5	<5	<5	<5	<5	<5
		7	<5	<15	<5	<50	<50	<5	<5	<5	<5	<5	<5	<5
		14	<5	<15	<5	<50	<50	<5	<5	<5	<5	<5	<5	<5
		28	<5	<15	<5	<15	<5	<5	<5	7[a]	<5	<5	<5	12[a]

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[a] Value less than 3 times minimum detection limit.

(Continued)

TABLE A-40. (Continued)

Key to VOCs

1. chloromethane
2. bromomethane
3. vinyl chloride
4. chloroethane
5. methylene chloride
6. acetone
7. carbon disulfide
8. trichlorofluoromethane
9. 1,1-dichloroethene
10. 1,1-dichloroethane
11. trans-1,2-dichloroethene
12. chloroform
13. 1,2-dichloroethane
14. 2-butanone
15. 1,1,1-trichloroethane
16. carbon tetrachloride
17. vinyl acetate
18. bromodichloromethane
19. 1,2-dichloropropane
20. cis-1,3-dichloropropene
21. trichloroethene
22. dibromochloromethane
23. 1,1,2-trichloroethane
24. benzene
25. trans-1,3-dichloropropene
26. 2-chloroethylvinyl ether
27. bromoform
28. 2-hexanone
29. 4-methyl-2-pentanone
30. tetrachloroethene
31. 1,1,2,2-tetrachloroethane
32. toluene
33. chlorobenzene
34. ethylbenzene
35. styrene
36. total xylenes

TABLE A-41. BASE-NEUTRAL-ACID (BNA) SEMI-VOLATILE ORGANIC COMPOUND CONCENTRATIONS IN ANS 16.1 EXTRACTS OF TREATED SOILS COLLECTED AS CORES FROM THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT

Sample Source	Core Designation	Day Number	(All Concentrations in µg/L) 1	2	3	4	5	6	7	8	9	10
Lagoon North	LAN 5	1	<10	<10	<10	13	<10	13	180	220	140	<10
		3	<10	<10	<10	<10	<10	<10	100	120	95	<10
		7	<10	<10	<10	<10	<10	11	160	200	190	<10
		14	<10	<10	<10	120	<10	<10	120	150	140	<10
		28	<10	<10	<10	32	<10	<10	160	210	120	<10
Filter Sludge	FSA 1	1	<10	<10	<10	<10	<10	170	440	740	160	42
		3	<10	<10	<10	<10	<10	76	280	390	<10	22
		7	<10	<10	<10	31	<10	88	270	420	70	23
		14	<10	<10	<10	<10	<10	160	480	800	140	42
		28	<10	<10	<10	63	<10	120	380	630	110	37
Processing Facility	PFA 3	1	<10	11	<10	22	<10	<10	18	26	<10	<10
		3	<10	<10	<10	31	<10	<10	<10	<10	<10	<10
		7	<10	13	<10	19	<10	<10	14	24	<10	<10
		14	<10	11[a]	<10	<10	<10	<10	<10	<10	<10	<10
		28	<10	<10	<10	73	<10	<10	<10	<10	<10	<10
Lagoon South	LAS SM2	1	<10	12	<10	<10	<10	12	76	84	28	<10
		3	<10	<10	<10	23	<10	<10	62	66	33	<10
		7	<10	11	<10	<10	<10	16	100	110	36	<10
		14	<10	10[a]	<10	<10	<10	<10	52	55	19[a]	<10
		28	<10	<10	<10	15	<10	<10	63	56	22	<10

[a] Less than 3 times the detection limit.

Compound No.	Name	Compound No.	Name
1	diethylphthlate	6	2-methylphenol
2	di n-butyl phthalate	7	4-methylphenol
3	benzo (a) anthracene	8	phenol
4	bis (2-ethylhexyl) phthalate	9	2,4-dimethylphenol
5	1,2-dichlorobenzene	10	naphthalene

TABLE A-41. (Continued)

BNA Compounds Not Detected			
Compound	Detection Limit	Compound	Detection Limit
acenaphthene	10	anilined	660
acenaphthylene	10	benzyl alcohol	1300
1-chloronaphthalene	10	bis(2-chloroethyl)ether	660
2-chloronaphthalene	10	bis(2-chloroisopropyl)ether	660
4-chlorophenyl phenyl ether	10	2-chlorophenol	660
dibenzofuran	10	1,3-dichlorobenzene	660
dimethyl phthalate	660	1,4-dichlorobenzene	660
2,4-dinitrophenol	10	ethyl methanesulfonate	660
2,4-dinitrotoluene	50	hexachloroethane	660
2,6-dinitrotoluene	10	methyl methanesulfonate	660
fluorene	660	n-nitrosodimethylamine	660
hexachlorocyclopentadiene	10	n-nitroso-di-n-propylamine	660
1-naphthylamine	10	2-picoline	660
2-naphthylamine	10	acetophenone	660
2-nitroaniline	50	benzoic acid	660
3-nitroaniline	50	bis(2-chloroethoxy)methane	660
4-nitroaniline	50	4-chloroaniline	1300
4-nitrophenol	50	4-chloro-3-methylphenol	1300
pentachlorobenzene	10	2,4-dichlorophenol	660
1,2,4,5-tetrachlorobenzene	10	2,6-dichlorophenol	660
2,3,4,6-tetrachlorophenol	10	a,a-dimethyl-phenethylamine	660
2,4,6-trichlorophenol	10	hexachlorobutadiene	660
2,4,5-trichlorophenol	10	isophorone	660
4-aminobiphenyl	10	2-methylnaphthalene	660
anthracene	660	nitrobenzene	660
4-bromophenyl phenyl ether	10	2-nitrophenol	660
4,6-dinitro-2-methylphenol	50	n-nitroso-di-n-butylamine	660
diphenylamine	660	n-nitrosopiperidine	660
1,2-diphenylhydrazine	10	1,2,4-trichlorobenzene	660
fluoranthene	660	benzo(b)fluoranthene	660
hexachlorobenzene	10	benzo(k)fluoranthene	660
n-nitrosodiphenylamine	660	benzo(g,h,i)perylene	660
pentachlorophenol	3300	benzo(a)pyrene	660
pentachloronitrobenzene	10	dibenz(a,j)acridine	660
phenacetin	10	dibenz(a,h)anthracene	660
phenanthrene	660	12-dimethylbenz(a)anthracene	660
pronamide	660	di-n-octylphthalate	660
benzidine	10	indeno(1,2,3-cd)pyrene	
butylbenzylphthalate	660	3-methylchloanthene	
chrysene	660		
3,3'-dichlorobenzidine	20		
p-dimethylaminoazobenzene	660		
pyrene	660		

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TABLE A-42. PRIORITY POLLUTANT METALS CONCENTRATIONS IN ANS 16.1 EXTRACTS OF TREATED SOILS COLLECTED AS FIELD CORES FROM THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION

Sample Source	Block Designation	(All Concentrations in mg/L)					
		Cadmium	Chromium	Copper	Lead	Nickel	Zinc
Lagoon North	Day 1	<0.003	<0.008	<0.03	0.008	<0.02	<0.01
LAN 5	Day 3	<0.003	<0.008	<0.03	0.009	<0.02	0.029
	Day 7	<0.02	<0.008	<0.03	0.052	<0.02	0.016
	Day 14	<0.003	<0.014	<0.05	0.048	<0.02	0.043
	Day 28	<0.019	<0.037	<0.13	0.028	<0.66	<0.011
Filter Sludge	Day 1	<0.004	0.015[a]	<0.04	0.14	<0.03	0.009
FSA 1	Day 3	<0.003	0.011[a]	<0.03	0.05	<0.02	0.028
	Day 7	<0.02	<0.008	<0.03	0.47	<0.02	0.029
	Day 14	<0.007	<0.014	<0.05	0.468	<0.02	0.011[a]
	Day 28	<0.007	<0.013	<0.05	0.247	<0.02	<0.004
Processing Facility	Day 1	<0.003	0.011[a]	<0.03	0.036	<0.02	<0.01
PFA 3	Day 3	<0.003	<0.008	<0.03	0.022	<0.02	0.031
	Day 7	<0.02	<0.008	<0.03	0.186	<0.02	0.016
	Day 14	<0.007	<0.014	<0.05	0.162	<0.02	0.011[a]
	Day 28	<0.007	<0.013	<0.05	0.184	<0.02	<0.004
Lagoon South	Day 1	<0.003	<0.018[a]	<0.03	0.013	<0.02	<0.020
LAS SM2	Day 3	<0.004	<0.01	<0.04	0.026	<0.03	0.001
	Day 7	<0.02	<0.008	<0.03	0.12	<0.02	<0.03
	Day 14	<0.007	<0.014	<0.05	0.110	<0.02	<0.004
	Day 28	<0.007	<0.013	<0.05	0.112	<0.02	<0.004

[a] Less than three times the detection limit.

TABLE A-43. OIL AND GREASE CONCENTRATIONS IN ANS 16.1 EXTRACTS OF TREATED SOILS COLLECTED AS FIELD CORES FROM THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT

Sample Type	Core Designation	(All Concentrations in mg/L)				
		Day 1	Day 3	Day 7	Day 14	Day 28
Lagoon North	LAN 5	<0.4	<0.4	<0.4	<0.4	4.7
Filter Sludge	FSA 1	<0.4	<0.4	1.6[a]	1.8[a]	1.5[a]
Processing Facility	PFA 3	<0.4	<0.4	<0.4	1.6[a]	0.7[a]
Lagoon South	LAS SM2	<0.4	<0.4	<0.4	<0.4	0.7[a]
Blank	--	--	--	--	--	<0.4

[a] Value less than 5 times detection limit.

TABLE A-44. POLYCHLORINATED BIPHENYLS (PCBs) CONCENTRATIONS IN MCC-1P EXTRACTS OF TREATED SOILS COLLECTED AS FIELD CORES FROM THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT ESTIMATED BY GAS CHROMATOGRAPHY METHOD 8080

Sample Type	Core Designation	Day 3	Day 7	Day 14	Day 28
Blank					NP[a]
Lagoon North	LAN 5	680 HA[b]	680 HA	B 680[c]	680 HA
Filter Sludge	FSA 1	680 HA	B 680	B 680	680 HA
Processing Facility	PFA 3	B 680	B 680	680 LA[d]	680 LA
Lagoon South	LAS SM2	680 LA	B 680	680 LA	680 LA

[a] No discernible peaks.
[b] Candidate for 680 test; high level, Group A.
[c] Peaks detected, but below 680 method detection limit.
[d] Candidate for 680 test; low level, Group A.

TABLE A-45. POLYCHLORINATED BIPHENYLS (PCBs) CONCENTRATIONS IN MCC-1P EXTRACTS OF TREATED SOILS COLLECTED AS FIELD CORES FROM THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT ESTIMATED BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY METHOD 680

			(All Concentrations in µg/L)									
Sample Source	Core Designation	Day	Monochloro-Biphenyl	Dichloro-Biphenyl	Trichloro-Biphenyl	Tetrachloro-Biphenyl	Penta Biphenyl	Hexa Biphenyl	Hepta Biphenyl	Octa Biphenyl	Nona Biphenyl	Deca Biphenyl
Lagoon North	LAN 5	3	<0.05	<0.07	<0.07	<0.12	<0.10	<0.12	<0.18	<0.35	<0.30	<0.33
		7	<0.05	<0.07	<0.07	<0.12	<0.10	<0.12	<0.18	<0.35	<0.30	<0.33
		14	<0.05	<0.07	<0.07	<0.12	<0.10	<0.12	<0.18	<0.35	<0.30	<0.33
		28	<0.05	<0.07	<0.07	<0.12	<0.10	<0.12	<0.18	<0.35	<0.30	<0.33
Filter Sludge	FSA 1	3	<0.05	<0.07	<0.07	<0.12	<0.10	<0.12	<0.18	<0.35	<0.30	<0.33
		7	<0.05	<0.07	<0.07	<0.12	<0.10	<0.12	<0.18	<0.35	<0.30	<0.33
		14	<0.05	<0.07	<0.07	<0.12	<0.10	<0.12	<0.18	<0.35	<0.30	<0.33
		28	<0.05	<0.07	<0.07	<0.12	<0.10	<0.12	<0.18	<0.35	<0.30	<0.33
Processing	PFA 3	3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		14	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		28	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lagoon South	LAS SM2	3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		14	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		28	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

[a] NA = Not analyzed.

TABLE A-46. VOLATILE ORGANIC COMPOUND CONCENTRATIONS IN MCC-1P EXTRACTS OF TREATED SOILS COLLECTED AS FIELD CORES FROM THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT

			(All Concentrations in µg/L)											
Sample Source	Core Designation	Day Number	1	2	3	4	5	6	7	8	9	10	11	12
Blank	--	28	<10	<10	<10	<10	10	<100	<5	<5	<5	<5	<5	<5
Lagoon North	LAN	3	<10	<10	<10	<10	<5	140[a]	<5	<5	<5	<5	<5	<5
		7	<10	<10	<10	<10	<5	370	<5	<5	<5	<5	<5	<5
		14	<10	<10	<10	<10	<5	270	<5	<5	<5	<5	<5	<5
		28	<10	<10	<10	<10	6[a]	670	<5	<5	<5	<5	<5	<5
Filter Sludge	FSA	3	<10	<10	<10	<10	12[a]	170[a]	<5	<5	<5	<5	<5	<5
		7	<10	<10	<10	<10	17	230[a]	<5	<5	<5	<5	<5	<5
		14	<5	<10	<10	<10	<5	700	<5	<5	<5	<5	<5	<5
		28	<10	<10	<10	<10	36	1200	<5	<5	<5	<5	<5	<5
Processing Facility	PFA	3	<10	<10	<10	<10	<5	<100	<5	<5	<5	<5	<5	<5
		7	<10	<10	<10	<10	5[a]	100[a]	<5	<5	<5	<5	<5	<5
		14	<5	<10	<10	<10	<5	610	<5	<5	<5	<5	<5	<5
		28	<10	<10	<10	<10	<5	278	<5	<5	<5	<5	<5	<5
Lagoon South	LAS	3	<10	<10	<10	<10	<5	100[a]	<5	<5	<5	<5	<5	<5
		7	<10	<10	<10	<10	<5	<100	<5	<5	<5	<5	<5	<5
		14	<5	<10	<10	<10	<5	280	<5	<5	<5	<5	<5	<5
		28	<10	<10	<10	<10	<5	720	<5	<5	<5	<5	<5	<5

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[a] Value is less than three times the detection limit.

(Continued)

TABLE A-46. (Continued)

Sample Source	Core Designation	Day Number	(All Concentrations in μg/L) 13	14	15	16	17	18	19	20	21	22	23	24
Blank		28	<5	<100	<5	<5	<50	<5	<5	<5	<5	<5	<5	<5
Lagoon North	LAN	3	<5	<100	<5	<5	<50	<5	<5	<5	<5	<5	<5	<5
		7	<5	<100	<5	<5	<50	<5	<5	<5	<5	<5	<5	<5
		14	<5	<60	<5	<5	<50	<5	<5	<5	<5	<5	<5	<5
		28	<5	110[a]	<5	<5	<50	<5	<5	<5	<5	<5	<5	<5
Filter Sludge	FSA	3	<5	<100	10[a]	<5	<50	<5	<5	<5	87	<5	<5	61
		7	<5	<100	8[a]	<5	<50	<5	<5	<5	64	<5	<5	76
		14	<5	110[a]	<5	<5	<50	<5	<5	<5	120	<5	<5	42
		28	<5	180[a]	12[a]	<5	<50	<5	<5	<5	130	<5	<5	60
Processing Facility	PFA	3	<5	<100	<5	<5	<50	<5	<5	<5	<5	<5	<5	<5
		7	<5	<100	<5	<5	<50	<5	<5	<5	<5	<5	<5	<5
		14	<5	96[a]	<5	<5	<50	<5	<5	<5	7[a]	<5	<5	<5
		28	<5	<100	<5	<5	<50	<5	<5	<5	<5	<5	<5	<5
Lagoon South	LAS	3	<5	<100	<5	<5	<50	<5	<5	<5	<5	<5	<5	<5
		7	<5	<100	<5	<5	<50	<5	<5	<5	<5	<5	<5	<5
		14	<5	<60	<5	<5	<50	<5	<5	<5	<5	<5	<5	<5
		28	<5	110[a]	<5	<5	<50	<5	<5	<5	10[a]	<5	<5	<5

[a] Value is less than three times the detection limit.

(Continued)

TABLE A-46. (Continued)

Sample Source	Core Designation	Day Number	25	26	27	28	29	30	31	32	33	34	35	36
			(All Concentrations in μg/L)											
Blank		28	<5	<15	<5	<5	<50	<5	<5	<5	<5	<5	<5	<5
Lagoon North	LAN	3	<5	<15	<5	<50	<50	<5	<5	5[a]	<5	<5	<5	<5
		7	<5	<15	<5	<50	<50	<5	<5	8[a]	<5	<5	<5	<5
		14	<5	<15	<5	<15	<5	<5	<5	9[a]	<5	<5	<5	6[a]
		28	<5	<15	<5	<15	<50	<5	<5	13[a]	<5	<5	<5	9[a]
Filter Sludge	FSA	3	<5	<15	<5	100	<50	10[a]	<5	210	<5	52	<5	330
		7	<5	<15	<5	<50	<50	<5	<5	170	<5	33	<5	220
		14	<5	<15	<5	33	<5	14[a]	<5	250	<5	170	<5	350
		28	<5	<15	<5	<5	<50	17	<5	270	<5	69	<5	370
Processing Facility	PFA	3	<5	<15	<5	<50	<50	<5	<5	91	<5	<5	<5	<5
		7	<5	<15	<5	<50	<50	<5	<5	240	<5	<5	<5	8[a]
		14	<5	<15	<5	<15	<5	<5	<5	260	<5	<5	<5	20
		28	<5	<15	<5	<5	<50	<5	<5	94	<5	<5	<5	6[a]
Lagoon South	LAS	3	<5	<15	<5	<50	<50	<5	<5	<5	<5	<5	<5	6[a]
		7	<5	<15	<5	<50	<50	<5	<5	11[a]	<5	<5	<5	14[a]
		14	<5	<15	<5	<15	<5	<5	<5	7[a]	<5	<5	<5	10[a]
		28	<5	<15	<5	<5	<50	11[a]	<5	18	<5	<5	<5	28

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[a] Value is less than three times the detection limit

(Continued)

TABLE A-46. (Continued)

Key to VOCs

1. chloromethane
2. bromomethane
3. vinyl chloride
4. chloroethane
5. methylene chloride
6. acetone
7. carbon disulfide
8. trichlorofluoromethane
9. 1,1-dichloroethene
10. 1,1-dichloroethane
11. trans-1,2-dichloroethene
12. chloroform
13. 1,2-dichloroethane
14. 2-butanone
15. 1,1,1-trichloroethane
16. carbon tetrachloride
17. vinyl acetate
18. bromodichloromethane
19. 1,2-dichloropropane
20. cis-1,3-dichloropropene
21. trichloroethene
22. dibromochloromethane
23. 1,1,2-trichloroethane
24. benzene
25. trans-1,3-dichloropropene
26. 2-chloroethylvinyl ether
27. bromoform
28. 2-hexanone
29. 4-methyl-2-pentanone
30. tetrachloroethene
31. 1,1,2,2-tetrachloroethane
32. toluene
33. chlorobenzene
34. ethylbenzene
35. styrene
36. total xylenes

TABLE A-47. BASE-NEUTRAL-ACID (BNA) SEMI-VOLATILE ORGANIC COMPOUND CONCENTRATIONS IN MCC-1P EXTRACTS OF TREATED SOILS COLLECTED AS FIELD CORES FROM THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT

Sample Source	Core Designation	Day Number	(All Concentrations in μg/L)												
			1	2	3	4	5	6	7	8	9	10	11	12	13
Lagoon North	LAN 5	3	<10	<10	<10	17	<10	<10	190	200	150	<10	<10	<10	<10
		7	<10	<10	<10	<10	<10	33	430	520	390	<10	<10	<10	<10
		14	<10	<10	<10	<10	<10	32	430	520	170	<10	<10	<10	<10
		28	<10	<10	<10	49	<10	69	1000	1000	800	<10	<10	<10	<10
Filter Sludge	FSA 1	3	<10	<10	<10	31	15	530	1500	2500	480	77	<10	<10	<10
		7	<10	<10	<10	<10	<10	360	1200	1700	310	37	<10	<10	<10
		14	<10	<10	<10	<10	<10	790	2300	3700	610	74	<10	<10	<10
		28	<10	<10	<10	<10	23[a]	1500	4300	7000	830	120	<10	<10	<10
Processing Facility	PFA 3	3	<10	<10	<10	<10	89	<10	20	38	<10	<10	<10	<10	<10
		7	<10	12	<10	<10	<10	<10	19	75	<10	<10	<10	<10	<10
		14	<10	<10	<10	10[a]	<10	<10	59	100	30[a]	11[a]	<10	<10	<10
		28	<10	<10	<10	<10	<10	<10	61	99	30	<10	33	29[a]	16[a]
Lagoon South	LAS SM2	3	<10	<10	<10	57	<10	<10	97	93	27	<10	<10	<10	<10
		7	<10	12	<10	<10	<10	<10	42	150	<10	<10	<10	<10	<10
		14	<10	<10	<10	<10	<10	58	380	360	60	<10	<10	<10	<10
		28	<10	<10	<10	<10	<10	100	620	590	120	<10	<10	<10	<10

[a] Less than 3 times the detection limit.

Compound No.	Name
1	diethylphthlate
2	di-n-butyl phthalate
3	benzo(a)anthracene
4	bis(2-ethylhexyl)phthalate
5	1,2-dichlorobenzene
6	2-methylphenol
7	4-methylphenol

Compound No.	Name
8	phenol
9	2,4-dimethylphenol
10	naphthalene
11	anthracene
12	fluoranthene
13	pyrene

TABLE A-47. (Continued)

BNA Compounds Not Detected			
Compound	Detection Limit	Compound	Detection Limit
acenaphthene	10	aniline	660
acenaphthylene	10	benzyl alcohol	1300
1-chloronaphthalene	10	bis(2-chloroethyl)ether	660
2-chloronaphthalene	10	bis(2-chloroisopropyl)ether	660
4-chlorophenyl phenyl ether	10	2-chlorophenol	660
dibenzofuran	10	1,3-dichlorobenzene	660
dimethyl phthalate	660	1,4-dichlorobenzene	660
2,4-dinitrophenol	10	ethyl methanesulfonate	660
2,4-dinitrotoluene	50	hexachloroethane	660
2,6-dinitrotoluene	10	methyl methanesulfonate	660
fluorene	660	n-nitrosodimethylamine	660
hexachlorocyclopentadiene	10	n-nitroso-di-n-propylamine	660
1-naphthylamine	10	2-picoline	660
2-naphthylamine	10	acetophenone	660
2-nitroaniline	50	benzoic acid	660
3-nitroaniline	50	bis(2-chloroethoxy)methane	660
4-nitroaniline	50	4-chloroaniline	1300
4-nitrophenol	50	4-chloro-3-methylphenol	1300
pentachlorobenzene	10	2,4-dichlorophenol	660
1,2,4,5-tetrachlorobenzene	10	2,6-dichlorophenol	660
2,3,4,6-tetrachlorophenol	10	a,a-dimethyl-phenethylamine	660
2,4,6-trichlorophenol	10	hexachlorobutadiene	660
2,4,5-trichlorophenol	10	isophorone	660
4-aminobiphenyl	10	2-methylnaphthalene	660
4-bromophenyl phenyl ether	10	nitrobenzene	660
4,6-dinitro-2-methylphenol	50	2-nitrophenol	660
diphenylamine	660	n-nitroso-di-n-butylamine	660
1,2-diphenylhydrazine	10	n-nitrosopiperidine	660
hexachlorobenzene	10	1,2,4-trichlorobenzene	660
n-nitrosodiphenylamine	660	benzo(b)fluoroanthene	660
pentachlorophenol	3300	benzo(k)fluoranthene	660
pentachloronitrobenzene	10	benzo(g,h,i)perylene	660
phenacetin	10	benzo(a)pyrene	660
phenanthrene	660	dibenz(a,j)acridine	660
pronamide	660	dibenz(a,h)anthracene	660
benzidine	10	12-dimethylbenz(a)anthracene	660
butylbenzylphthalate	660	di-n-octylphthalate	660
chrysene	660	indeno(1,2,3-cd)pyrene	660
3,3'-dichlorobenzidine	20	3-methylchloanthene	660
p-dimethylaminoazobenzene	660		

TABLE A-48. PRIORITY POLLUTANT METALS CONCENTRATIONS IN MCC-1P EXTRACTS OF TREATED SOILS COLLECTED AS FIELD CORES FROM THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT

Sample Source	Block Designation	(All Concentrations in mg/L)					
		Cadmium	Chromium	Copper	Lead	Nickel	Zinc
Lagoon North	Day 3	<0.021	0.009[a]	<0.033	0.105	<0.019	0.018
LAN	Day 7	<0.021	<0.008	<0.033	0.072	<0.019	0.005
	Day 14	<0.007	<0.014	<0.047	0.098	<0.023	<0.004
	Day 28	<0.007	<0.028	<0.047	0.106	<0.023	0.009[a]
Filter Sludge	Day 3	<0.021	0.009[a]	<0.033	0.359	<0.019	0.007
FSA	Day 7	<0.021	<0.008	<0.033	0.548	<0.019	0.001
	Day 14	<0.007	<0.014	<0.047	0.53	<0.023	<0.004
	Day 28	<0.019	<0.08	<0.134	0.60	<0.066	0.12
Processing Facility	Day 3	<0.021	<0.008	<0.033	0.372	<0.019	0.004
	Day 7	<0.051	<0.019	<0.081	0.448	<0.048	0.039
	Day 14	<0.007	<0.014	<0.047	0.695	<0.023	<0.004
	Day 28	<0.007	<0.028	<0.047	0.411	<0.023	0.017
Lagoon South	Day 3	<0.051	0.024[a]	<0.081	0.363	<0.048	<0.077
LAS	Day 7	<0.021	0.009[a]	<0.033	0.301	<0.019	<0.031
	Day 14	<0.007	<0.014	<0.070	0.359	<0.023	0.060
	Day 28	<0.007	<0.028	<0.047	0.55	<0.023	<0.007

[a] Less than three times the detection limit.

TABLE A-49. OIL AND GREASE CONCENTRATIONS IN MCC-1P EXTRACTS OF TREATED SOILS COLLECTED AS FIELD CORES FROM HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT

Sample Type	Core Designation	(All Concentrations in mg/L)			
		Day 3	Day 7	Day 14	Day 28
Lagoon North	LAN 5	2.6	6.1	5.6	5.3
Filter Sludge	FSA 1	5.2	5.5	5.0	5.1
Processing Facility	PFA 3	<0.4	<0.4	<0.4	1.0[a]
Lagoon South	LAS SM2	1.7[a]	2.2	5.6	3.1
Blank	--	--	--	--	<0.4

[a] Value less than 5 times detection limit.

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TABLE A-50. CHEMICAL ANALYSIS OF FEED WATER FROM THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT

Analyte	Units	Concentration in Feed Water
Carbonate (as $CaCO_3$)	mg/L	<1
Chemical Oxygen Demand	mg/L	<5
Chloride	mg/L	36
pH	pH units	8.05
Specific Conductance	µmhos/cm	616
Sulfate	mg/L	33
Total Dissolved Solids	mg/L	340
Total Organic Carbon	mg/L	<1
Total Suspended Solids	mg/L	1[a]

[a] Value less than 5 times detection limit.

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TABLE A-51. ELEMENTAL ANALYSIS[a] OF FEED WATER FROM THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT

Analyte	Concentration in Feed Water (mg/L)
Aluminum	0.3[b]
Antimony	<0.06
Arsenic	<0.3
Barium	0.065
Beryllium	<0.001
Bismuth	<0.8
Boron	<0.6
Cadmium	<0.003
Calcium	64
Chromium	<0.009
Cobalt	<0.01
Copper	4[b]
Gold	<0.2
Indium	<0.2
Iron	0.66
Lead	0.03[b,c]
Lithium	<0.02
Magnesium	16
Manganese	0.019
Molybdenum	<0.05
Nickel	<0.02
Phosphorous	<0.3
Platinum	<0.2
Potassium	1.7
Selenium	<0.3
Silicon	6.4
Silver	<0.009
Sodium	20
Strontium	0.093
Sulfur	10[b]
Tellurium	<0.2
Tin	<0.5
Titanium	<0.05
Thallium	<0.09
Tungsten	<0.1
Uranium	<0.5
Vanadium	<0.02
Yttrium	<0.009
Zinc	0.20

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[a] Concentrations measured using inductively coupled argon plasma emission spectrometry unless otherwise noted.

[b] Value is less than five times the detection limit.

[c] Measured by atomic absoprtion spectrophotometry-graphite furnace method.

APPENDIX B
PARTICLE SIZE DISTRIBUTION DATA

GRAIN SIZE DISTRIBUTION

Data Sheet 6

Project HAZCON

Job. No. 272-008

Location of Project DOUGLASSVILLE, PA

Boring No.

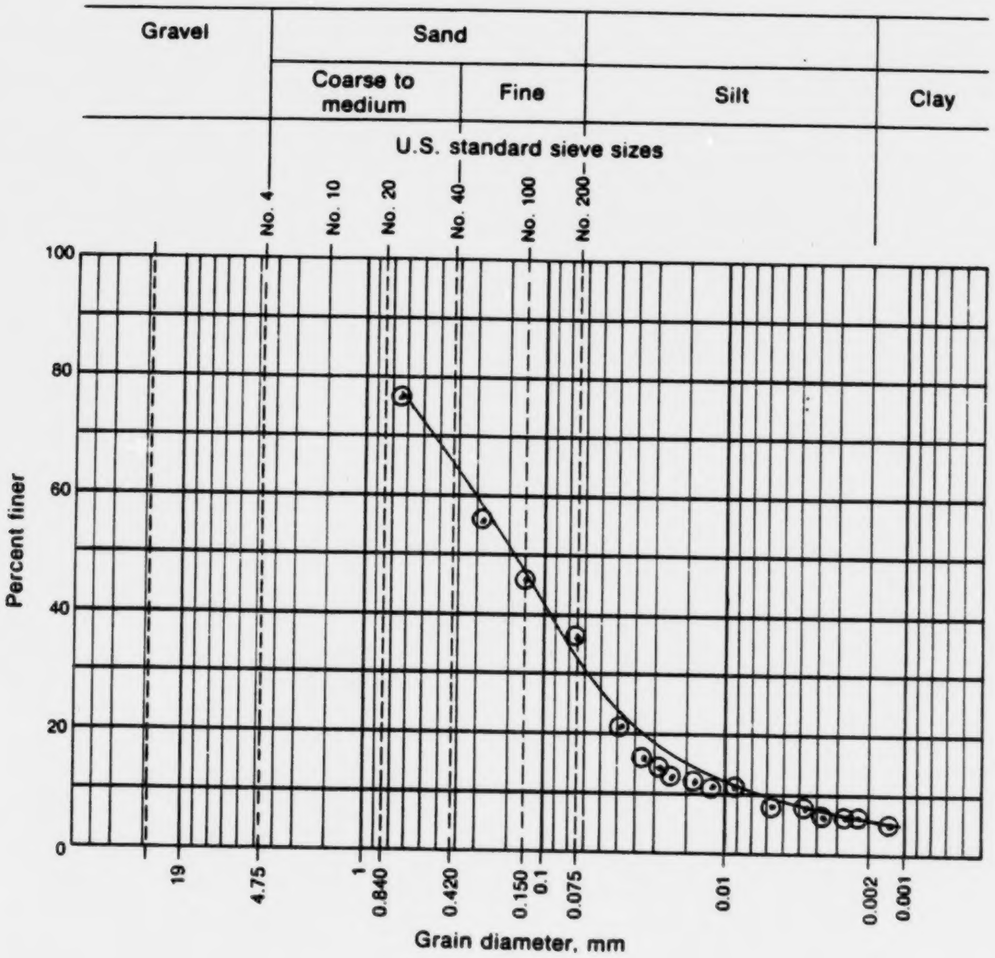
Sample No. HZ-248

Description of Soil BACKFILL #1 C1-T1

Depth of Sample

Tested By. B. BIRD

Date of Testing 11/11/87



Visual soil description

Soil classification:

System

Grain Size Analysis
Hydrometer & Mechanical

Project:	Hazcon 248
Date:	Nov. 11, 87
Specific Gravity:	2.65
a, corr. factor:	1.00
Wt. of Soil:	50.00
Zero Correction:	2.00
Meniscus Correction:	0.50
Temp. Correction:	0.40
K value:	0.01

Time(min)	R actual	% Finer	L	D(mm)x100	wt.Retnd.	% passing	Meniscus
1.00	12.00	20.80	14.20	4.94	11.30	77.40	12.50
2.00	10.00	16.80	14.60	3.54	10.80	55.80	10.50
3.00	9.00	14.80	14.70	2.90	4.90	46.00	9.50
4.00	8.00	12.80	14.90	2.53	4.80	36.40	8.50
8.00	7.50	11.80	15.00	1.79			8.00
15.00	7.00	10.80	15.10	1.31			7.50
30.00	7.00	10.80	15.10	0.93			7.50
60.00	6.00	8.80	15.20	0.66			6.50
120.00	6.00	8.80	15.20	0.47			6.50
240.00	5.00	6.80	15.40	0.33			5.50
360.00	5.00	6.80	15.40	0.27			5.50
420.00	5.00	6.80	15.40	0.25			5.50
1440.00	4.50	5.80	15.50	0.14			5.00

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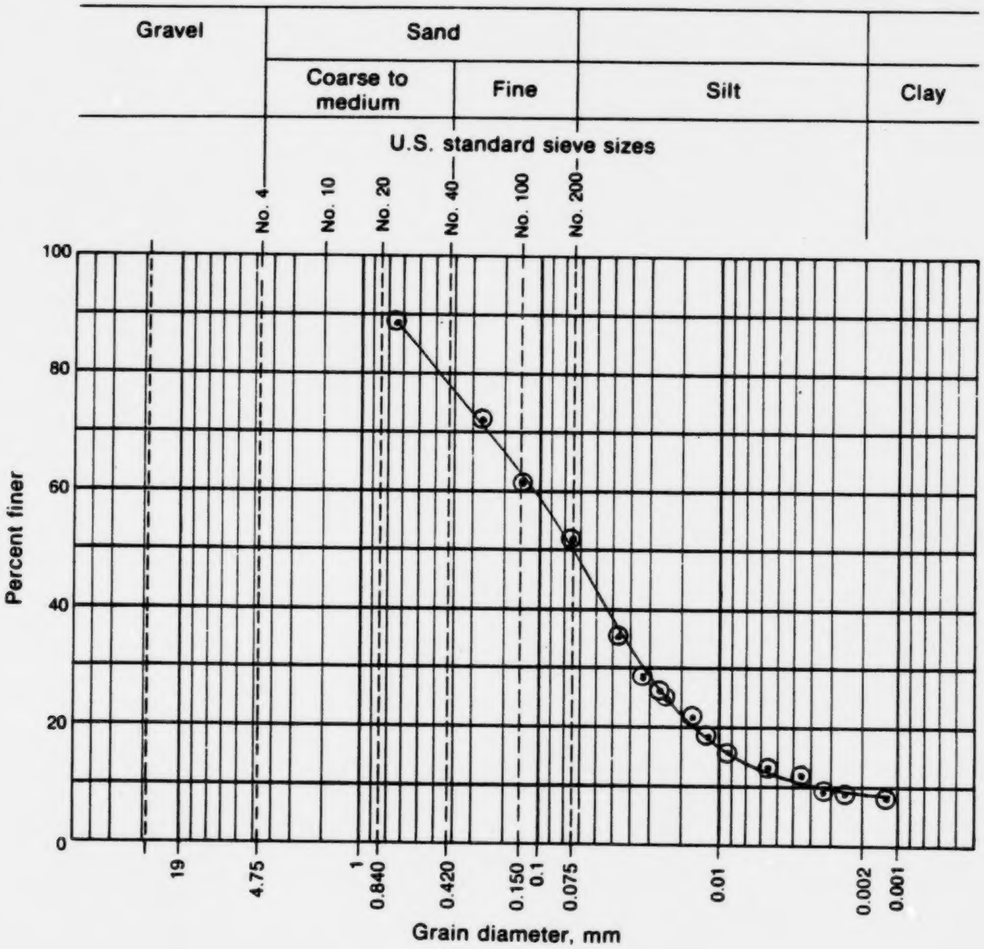
GRAIN SIZE DISTRIBUTION Data Sheet 6

Project HAZCON Job. No. 272-008

Location of Project DOUGLASSVILLE, PA Boring No. ________ Sample No. HZ-028

Description of Soil DSA C1-T1 Depth of Sample ________

Tested By. B. BIRD Date of Testing 11/3/87



Visual soil description ________________________________

Soil classification:

________________ System ________________

Grain Size Analysis
Hydrometer Method

Project:	Hazcon #028
Date:	Nov. 3 1987
Specific Gravity:	2.65
a, corr. factor:	1.00
Wt. of Soil:	50.00
Zero Correction:	2.50
Meniscus Correction:	0.50
Temp. Correction:	0.40
K value:	0.01

Time(min)	R actual	% Finer	D(mm)	L	wt.Retnd.	Meniscus
		97.98	0.7289		6.01	
		71.58	0.2972		8.20	
		61.50	0.1499		5.04	
		51.48	0.0750		5.01	
1.00	20.00	35.80	0.0471	12.90		20.50
2.00	17.00	29.80	0.0339	13.40		17.50
3.00	16.00	27.80	0.0279	13.60		16.50
4.00	15.00	25.80	0.0242	13.70		15.50
8.00	13.00	21.80	0.0174	14.10		13.50
15.00	11.50	18.80	0.0128	14.30		12.00
30.00	10.00	15.80	0.0091	14.60		10.50
60.00	9.00	13.80	0.0065	14.70		9.50
120.00	8.00	11.80	0.0046	14.90		8.50
240.00	7.00	9.80	0.0033	15.10		7.50
420.00	7.00	9.80	0.0025	15.10		7.50
1440.00	6.50	8.80	0.0013	15.20		7.00

GRAIN SIZE DISTRIBUTION

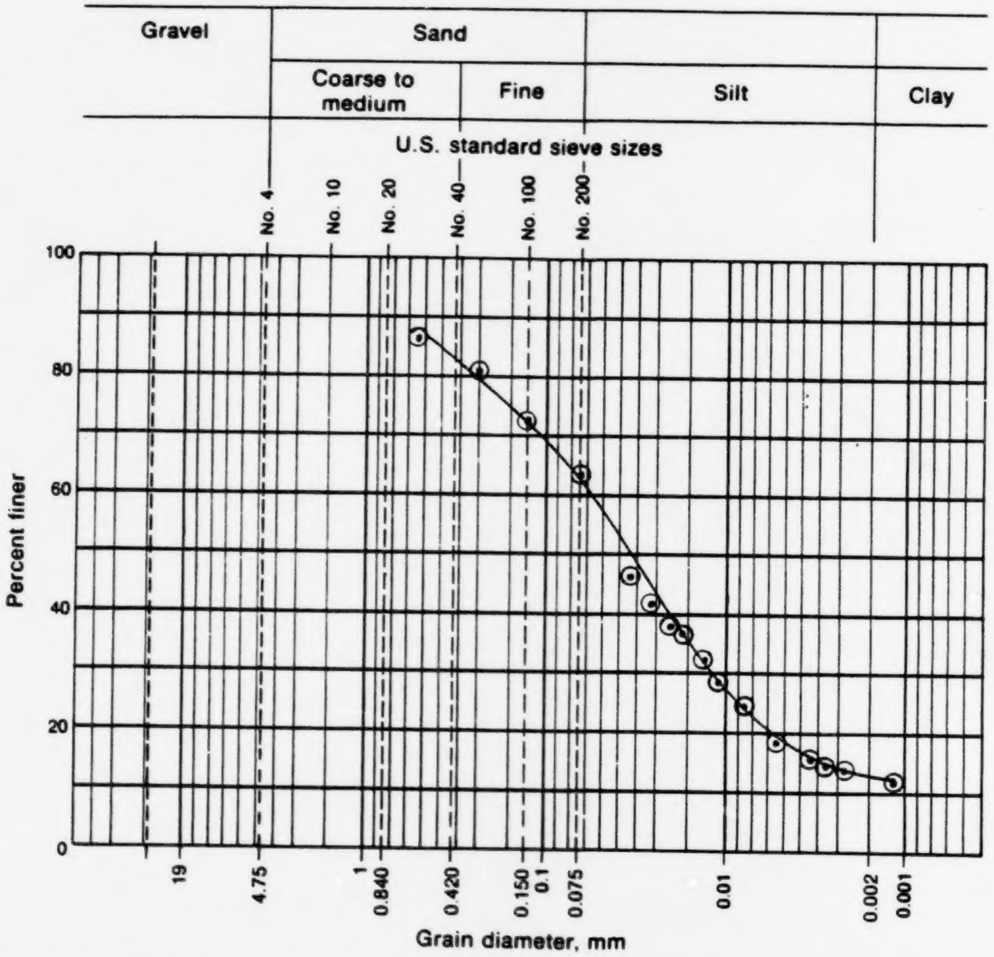
Data Sheet 6

Project HAZCON Job. No. 272-008

Location of Project DOUGLASSVILLE, PA Boring No. ____ Sample No. HZ-028 DUPLICATE

Description of Soil DSA C1-T1 Depth of Sample ____

Tested By. B. BIRD Date of Testing 11/9/87



Visual soil description ____

Soil classification:

____ System ____

Grain Size Analysis
Hydrometer & Mechanical

Project: Hazcon 028D
Date: NOv. 9, 87
Specific Gravity: 2.65
a, corr. factor: 1.00
Wt. of Soil: 50.00
Zero Correction: 3.00
Meniscus Correction: 0.50
Temp. Correction: 0.40
K value: 0.01

Time(min)	R actual	% Finer	L	D(mm)x100	wt.Retnd.	% passing	Meniscus
1.00	26.00	46.80	11.90	4.52	7.01	85.98	26.50
2.00	23.50	41.80	12.40	3.26	3.00	79.98	24.00
3.00	22.00	38.80	12.60	2.68	3.77	72.44	22.50
4.00	21.00	36.80	12.80	2.34	4.50	63.44	21.50
8.00	18.50	31.80	13.20	1.68			19.00
15.00	16.50	27.80	13.50	1.24			17.00
30.00	15.00	24.80	13.70	0.89			15.50
60.00	12.00	18.80	14.20	0.64			12.50
120.00	11.50	17.80	14.30	0.45			12.00
180.00	11.00	16.80	14.40	0.37			11.50
240.00	10.50	15.80	14.50	0.32			11.00
300.00	10.00	14.80	14.60	0.29			10.50
1440.00	9.00	12.80	14.70	0.13			9.50

GRAIN SIZE DISTRIBUTION

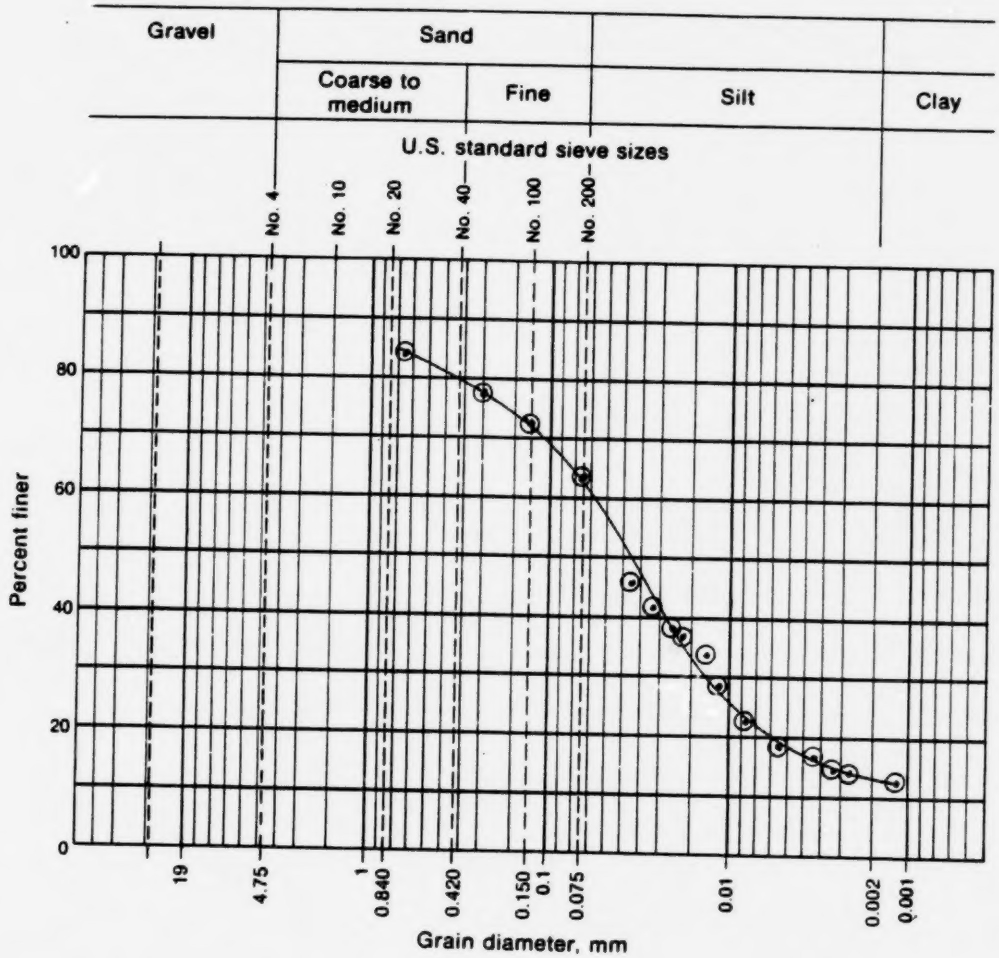
Data Sheet 6

Project HAZCON Job. No. 272-008

Location of Project DOUGLASSVILLE, PA Boring No. ______ Sample No. HZ-033

Description of Soil DSA C1-T2 Depth of Sample ______

Tested By. B. BIRD Date of Testing 11/3/87



Visual soil description ______

Soil classification:

______ System ______

Grain Size Analysis
Hydrometer & Mechanical

Project: Hazcon #033
Date: NOv. 3, 1987
Specific Gravity: 2.65
a, corr. factor: 1.00
Wt. of Soil: 50.00
Zero Correction: 2.50
Meniscus Correction: 0.50
Temp. Correction: 0.40
K value: 0.01

Time(min)	R actual	% Finer	L	D(mm)x100	wt.Retnd.	% passing	Meniscus
1.00	25.00	45.80	12.10	4.56	8.03	83.94	25.50
2.00	23.00	41.80	12.40	3.26	3.36	77.22	23.50
3.00	22.00	39.80	12.60	2.68	2.90	71.42	22.50
4.00	21.00	37.80	12.80	2.34	4.13	63.16	21.50
8.00	19.00	33.80	13.10	1.68			19.50
15.00	16.00	27.80	13.60	1.25			16.50
30.00	14.00	23.80	13.90	0.89			14.50
60.00	12.00	19.80	14.20	0.64			12.50
120.00	11.00	17.80	14.40	0.45			11.50
240.00	9.00	13.80	14.70	0.32			9.50
420.00	9.00	13.80	14.70	0.25			9.50
1440.00	8.00	11.80	14.90	0.13			8.50

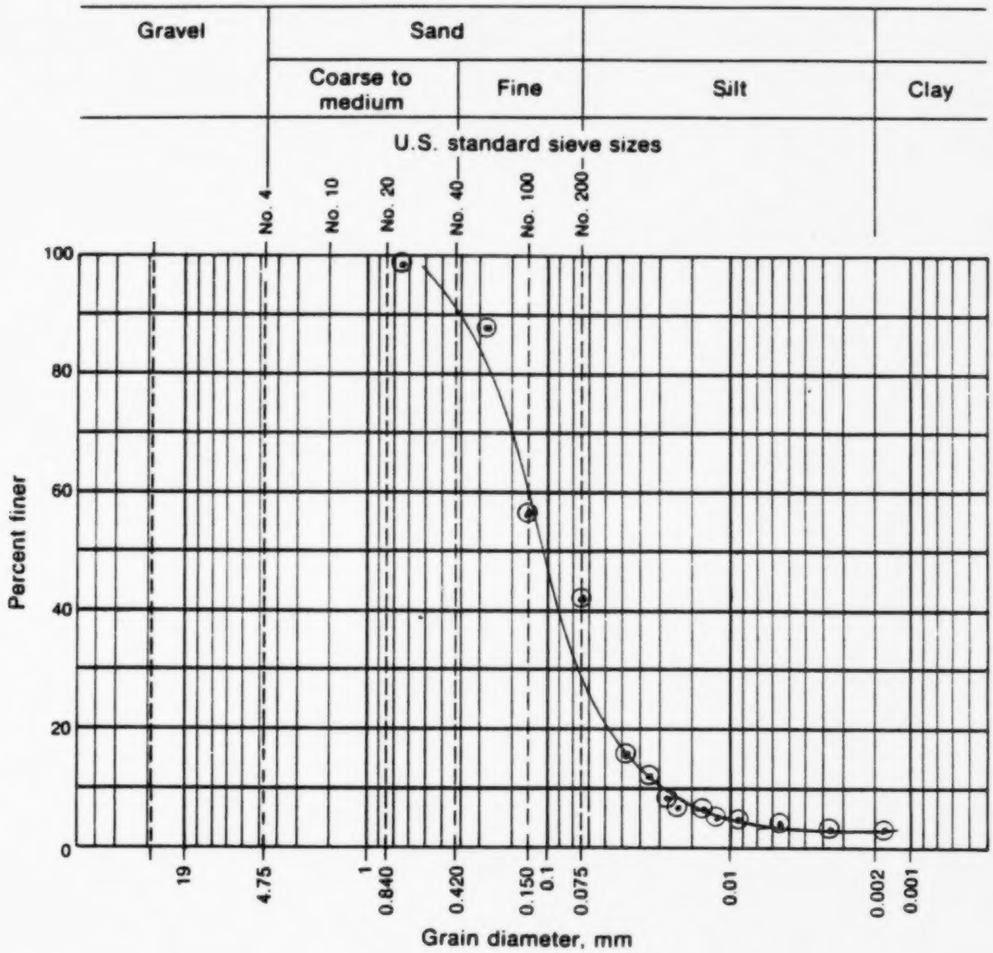
GRAIN SIZE DISTRIBUTION Data Sheet 6

Project HAZCON Job. No. 272-008

Location of Project DOUGLASSVILLE, PA Boring No. ______ Sample No. HZ-086

Description of Soil LAN C1-T1 Depth of Sample ______

Tested By. B. BIRD Date of Testing 11/11/87



Visual soil description ______

Soil classification:

______ System ______

Grain Size Analysis
Hydrometer & Mechanical

Project:	Hazcon 086
Date:	Nov. 11, 87
Specific Gravity:	2.65
a. corr. factor:	1.00
Wt. of Soil:	50.00
Zero Correction:	4.00
Meniscus Correction:	0.50
Temp. Correction:	0.40
K value:	0.01

Time(min)	R actual	% Finer	L	D(mm)x100	wt.Retnd.	% passing	Meniscus
1.00	12.00	16.80	14.20	4.94	1.09	97.82	12.50
2.00	9.50	11.80	14.70	3.55	4.58	88.66	10.00
3.00	8.50	9.80	14.80	2.91	16.72	55.22	9.00
4.00	8.00	8.80	14.90	2.53	6.35	42.52	8.50
8.00	8.00	8.80	14.90	1.79			8.50
15.00	7.00	6.80	15.10	1.31			7.50
30.00	7.00	6.80	15.10	0.93			7.50
60.00	7.00	6.80	15.10	0.66			7.50
180.00	5.50	3.80	15.30	0.38			6.00
240.00	5.00	2.80	15.40	0.33			5.50
360.00	5.00	2.80	15.40	0.27			5.50
1440.00	6.00	4.80	15.30	0.14			6.50

GRAIN SIZE DISTRIBUTION

Data Sheet 6

Project HAZCON

Job. No. 272-008

Location of Project DOUGLASSVILLE, PA

Boring No.

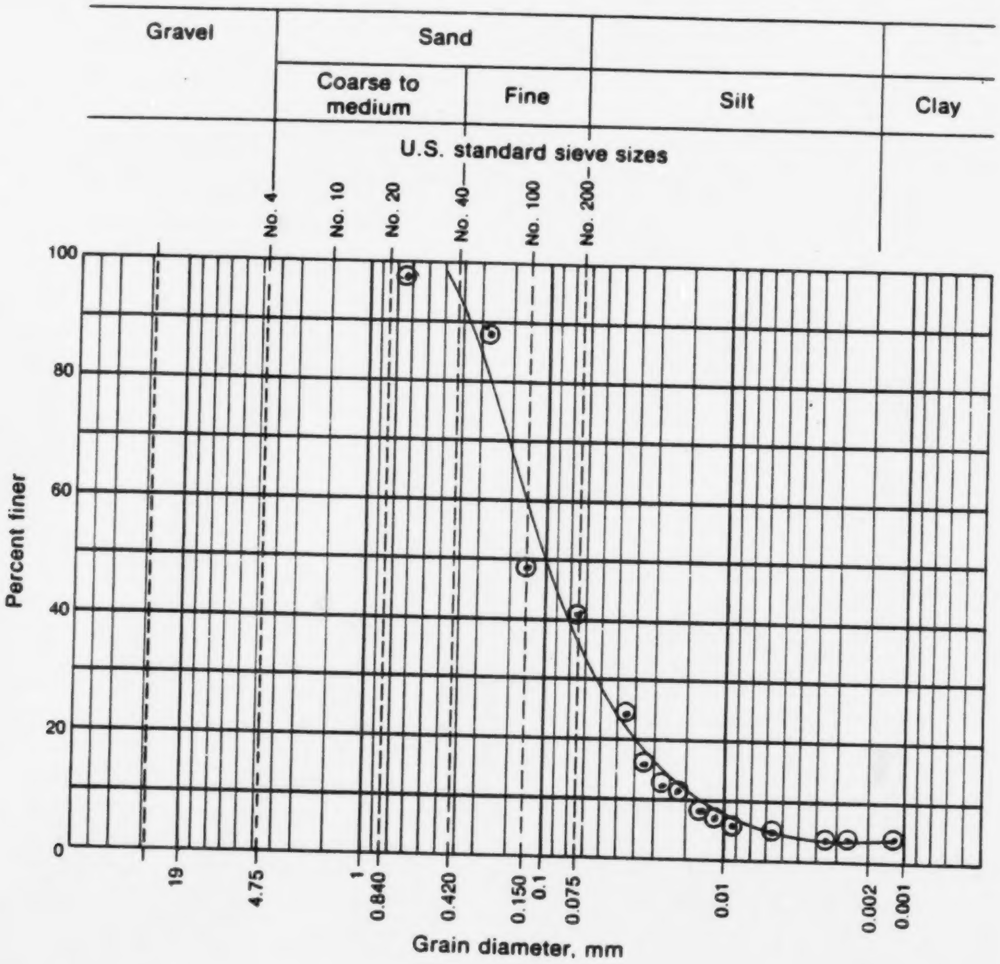
Sample No. HZ-080

Description of Soil LAN CI-TZ

Depth of Sample

Tested By. B. BIRD

Date of Testing 11/11/87



Visual soil description

Soil classification:

System

Grain Size Analysis
Hydrometer & Mechanical

Project:	Hazcon #080
Date:	Nov. 11. '87
Specific Gravity:	2.65
a, corr. factor:	1.00
Wt. of Soil:	50.00
Zero Correction:	3.00
Meniscus Correction:	0.50
Temp. Correction:	0.40
K value:	0.01

Time(min)	R actual	% Finer	L	D(mm)x100	wt.Retnd.	% passing	Meniscus
1.00	15.00	24.30	13.70	4.85	1.57	96.86	15.50
2.00	11.00	16.80	14.40	3.52	4.79	87.28	11.50
3.00	9.00	12.80	14.70	2.90	19.02	49.24	9.50
4.00	8.00	10.80	14.90	2.53	4.21	40.82	8.50
8.00	7.50	9.80	15.00	1.79			8.00
15.00	7.00	8.80	15.10	1.31			7.50
30.00	6.00	6.80	15.20	0.93			6.50
60.00	6.00	6.80	15.20	0.66			6.50
180.00	5.00	4.80	15.40	0.38			5.50
240.00	4.50	3.80	15.50	0.33			5.00
360.00	4.50	3.80					
1440.00	4.50	3.80					

GRAIN SIZE DISTRIBUTION

Data Sheet 6

Project HAZCON

Job. No. 272-008

Location of Project DOUGLASSVILLE, PA

Boring No.

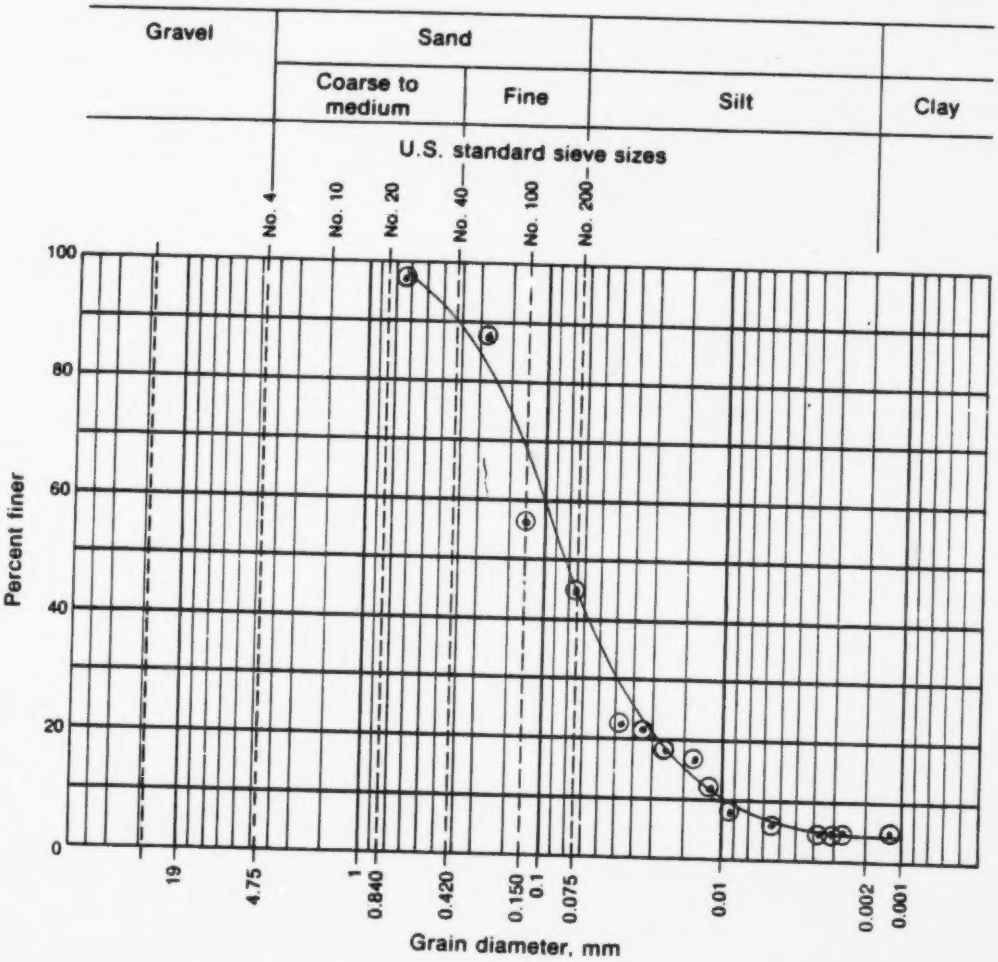
Sample No. HZ-062

Description of Soil LAN CZ-T1

Depth of Sample

Tested By. B. BIRD

Date of Testing 11/11/87



Visual soil description

Soil classification:

System

Grain Size Analysis
Hydrometer & Mechanical

Project:	Hazcon 062
Date:	Nov. 11, 87
Specific Gravity:	2.65
a. corr. factor:	1.00
Wt. of Soil:	50.00
Zero Correction:	4.00
Meniscus Correction:	0.50
Temp. Correction:	0.40
K value:	0.01

Time(min)	R actual	% Finer	L	D(mm)x100	wt.Retnd.	% passing	Meniscus
1.00	15.00	22.80	13.70	4.85	1.50	97.00	15.50
2.00	14.00	20.80	13.90	3.45	4.90	87.20	14.50
3.00	13.00	18.80	14.10	2.84	15.97	55.26	13.50
4.00	12.50	17.80	14.20	2.47	5.14	44.98	13.00
8.00	12.50	17.80	14.20	1.75			13.00
15.00	9.00	10.80	14.70	1.30			9.50
30.00	8.00	8.80	14.90	0.92			8.50
60.00	7.00	6.80	15.10	0.66			7.50
180.00	6.50	5.80	15.20	0.38			7.00
240.00	6.50	5.80	15.20	0.33			7.00
360.00	6.50	5.80	15.20	0.27			7.00
1440.00	6.50	5.80	15.20	0.13			7.00
							7.00

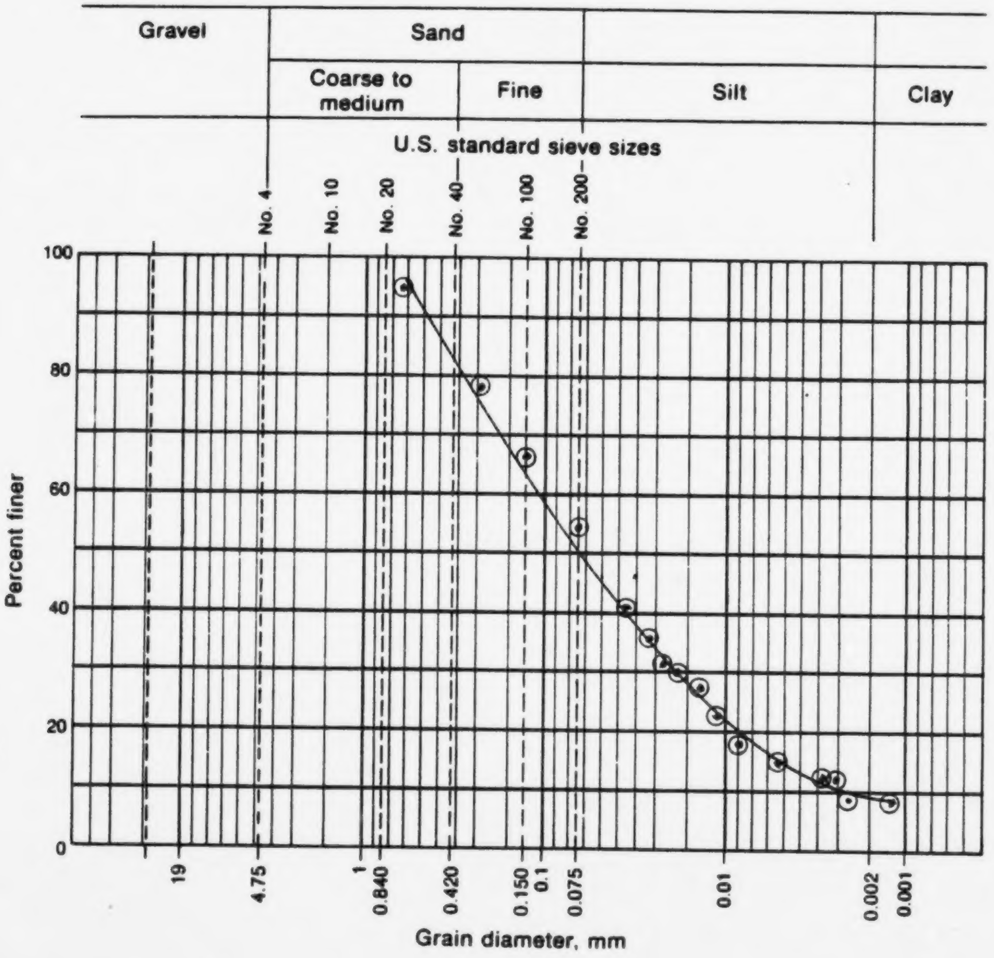
GRAIN SIZE DISTRIBUTION Data Sheet 6

Project HAZCON Job. No. 272-008

Location of Project DOUGLASSVILLE, PA Boring No. ______ Sample No. HZ-158

Description of Soil LFA C1-T1 Depth of Sample ______

Tested By. B. BIRD Date of Testing 11/11/87



Visual soil description ______

Soil classification:

______ System ______

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Grain Size Analysis
Hydrometer & Mechanical

Project:	Hazcon 158
Date:	Nov. 11, 87
Specific Gravity:	2.65
a, corr. factor:	1.00
Wt. of Soil:	50.00
Zero Correction:	3.00
Meniscus Correction:	0.50
Temp. Correction:	0.40
K value:	0.01

Time(min)	R actual	% Finer	L	D(mm)x100	wt.Retnd.	% passing	Meniscus
1.00	23.00	40.80	12.40	4.61	2.75	94.50	23.50
2.00	21.00	36.80	12.80	3.31	8.15	78.20	21.50
3.00	18.50	31.80	13.20	2.75	5.43	67.34	19.00
4.00	18.00	30.80	13.20	2.38	6.37	54.60	18.50
8.00	17.00	28.80	13.40	1.70			17.50
15.00	14.00	22.80	13.90	1.26			14.50
30.00	12.00	18.80	14.20	0.90			12.50
60.00	10.50	15.80	14.50	0.64			11.00
180.00	8.50	11.80	14.80	0.38			9.00
240.00	8.00	10.80	14.90	0.33			8.50
360.00	7.50	9.80	15.00	0.27			8.00
1440.00	7.50	9.80	15.00	0.13			8.00

GRAIN SIZE DISTRIBUTION

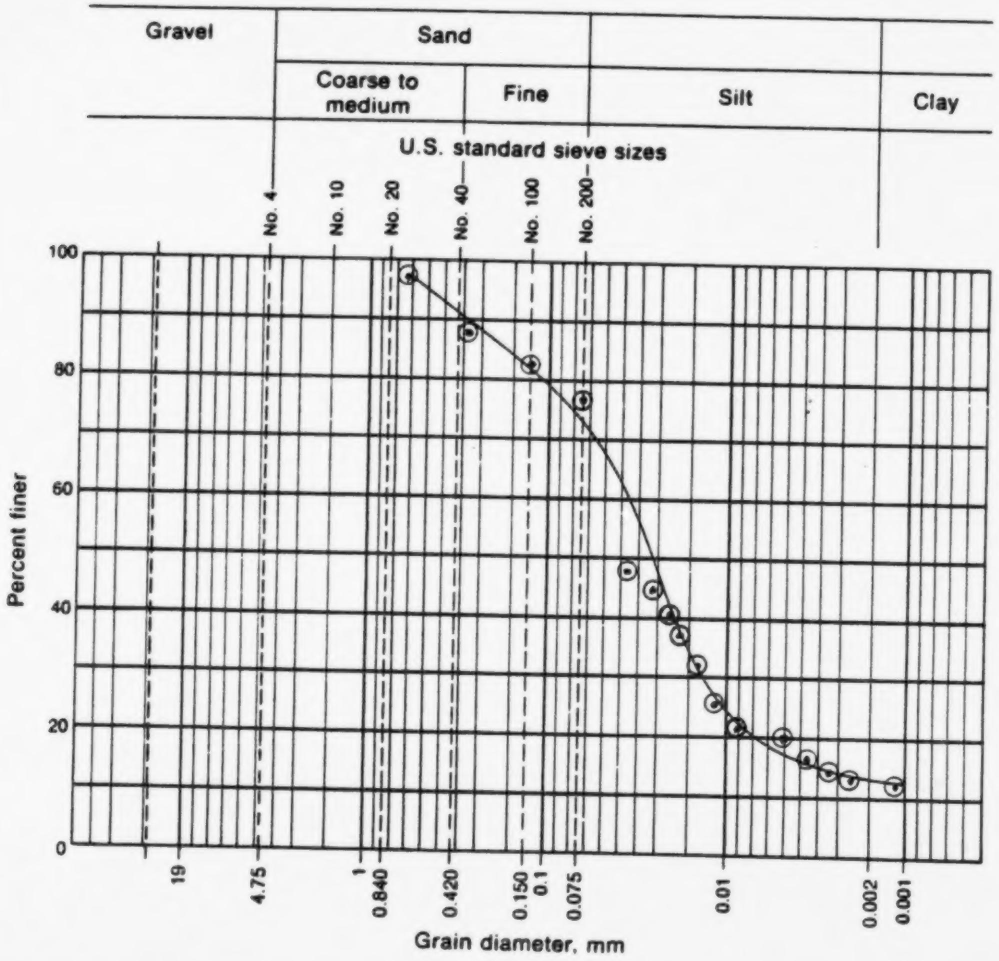
Data Sheet 6

Project HAZCON Job. No. 272-008

Location of Project DOUGLASSVILLE, PA Boring No. _____ Sample No. HZ-158 DUPLI

Description of Soil LFA C1-T1 Depth of Sample _____

Tested By. B. BIRD Date of Testing 11/3/87



Visual soil description _____

Soil classification:

_____ System _____

Grain Size Analysis
Hydrometer & Mechanical

Project: Hazcon 158D
Date: Nov. 3, 87
Specific Gravity: 2.65
a. corr. factor: 1.00
Wt. of Soil: 50.00
Zero Correction: 2.00
Meniscus Correction: 0.50
Temp. Correction: 0.40
K value: 0.01

Time(min)	R actual	% Finer	L	D(mm)x100	wt.Retnd.	% passing	Meniscus
1.00	26.00	48.80	11.90	4.52	1.19	97.62	26.50
2.00	24.00	44.80	12.30	3.25	4.78	88.06	24.50
3.00	22.00	40.80	12.60	2.68	2.83	82.40	22.50
4.00	20.00	36.80	12.90	2.35	2.59	77.22	20.50
8.00	17.50	31.80	13.30	1.69			18.00
15.00	14.50	25.80	13.80	1.26			15.00
30.00	13.00	22.80	14.10	0.90			13.50
60.00	12.00	20.80	14.20	0.64			12.50
120.00	10.00	16.80	14.60	0.46			10.50
240.00	9.00	14.80	14.70	0.32			9.50
420.00	8.50	13.80	14.80	0.25			9.00
1440.00	8.00	12.80	14.90	0.13			8.50

GRAIN SIZE DISTRIBUTION

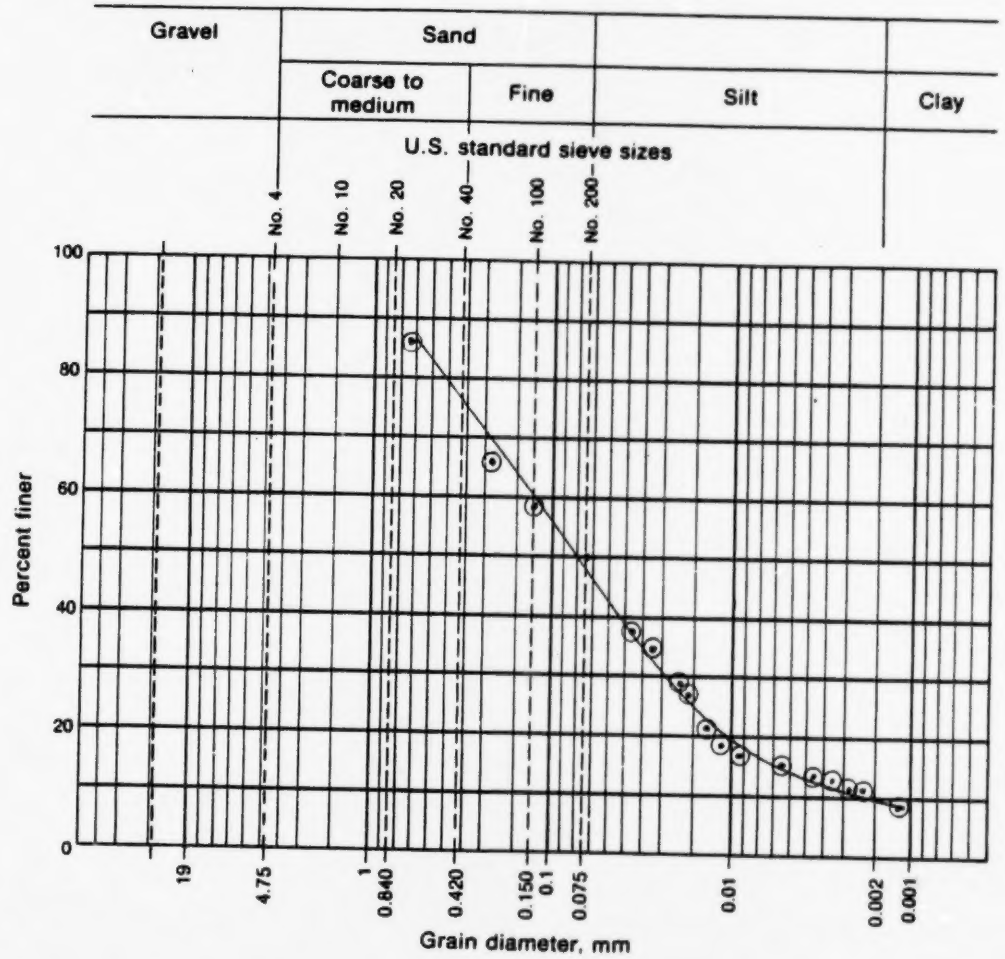
Data Sheet 6

Project HAZCON Job. No. 272-008

Location of Project DOUGLASSVILLE, PA Boring No. ______ Sample No. HZ-164

Description of Soil LFA C1-TZ Depth of Sample ______

Tested By. B. BIRD Date of Testing 11/11/87



Visual soil description ______

Soil classification:

______ System ______

Grain Size Analysis
Hydrometer & Mechanical

Project:	Hazcon 164
Date:	Nov. 11, 87
Specific Gravity:	2.65
a, corr. factor:	1.00
Wt. of Soil:	50.00
Zero Correction:	2.50
Meniscus Correction:	0.50
Temp. Correction:	0.40
K value:	0.01

Time(min)	R actual	% Finer	L	D(mm)x100	wt.Retnd.	% passing	Meniscus
1.00	21.00	37.80	12.80	4.69	11.30	77.40	21.50
2.00	20.00	35.80	12.90	3.33	6.70	64.00	20.50
3.00	17.00	29.80	13.40	2.77	2.50	59.00	17.50
4.00	16.00	27.80	13.60	2.42	4.10	50.80	16.50
8.00	13.50	22.80	14.00	1.73			14.00
15.00	12.00	19.80	14.20	1.27			12.50
30.00	11.00	17.80	14.40	0.91			11.50
60.00	10.00	15.80	14.60	0.65			10.50
120.00	9.00	13.80	14.70	0.46			9.50
240.00	8.00	11.80	14.90	0.33			8.50
360.00	7.50	10.80	15.00	0.27			8.00
420.00	7.50	10.80	15.00	0.25			8.00
1440.00	6.50	8.80	15.20	0.13			7.00

GRAIN SIZE DISTRIBUTION

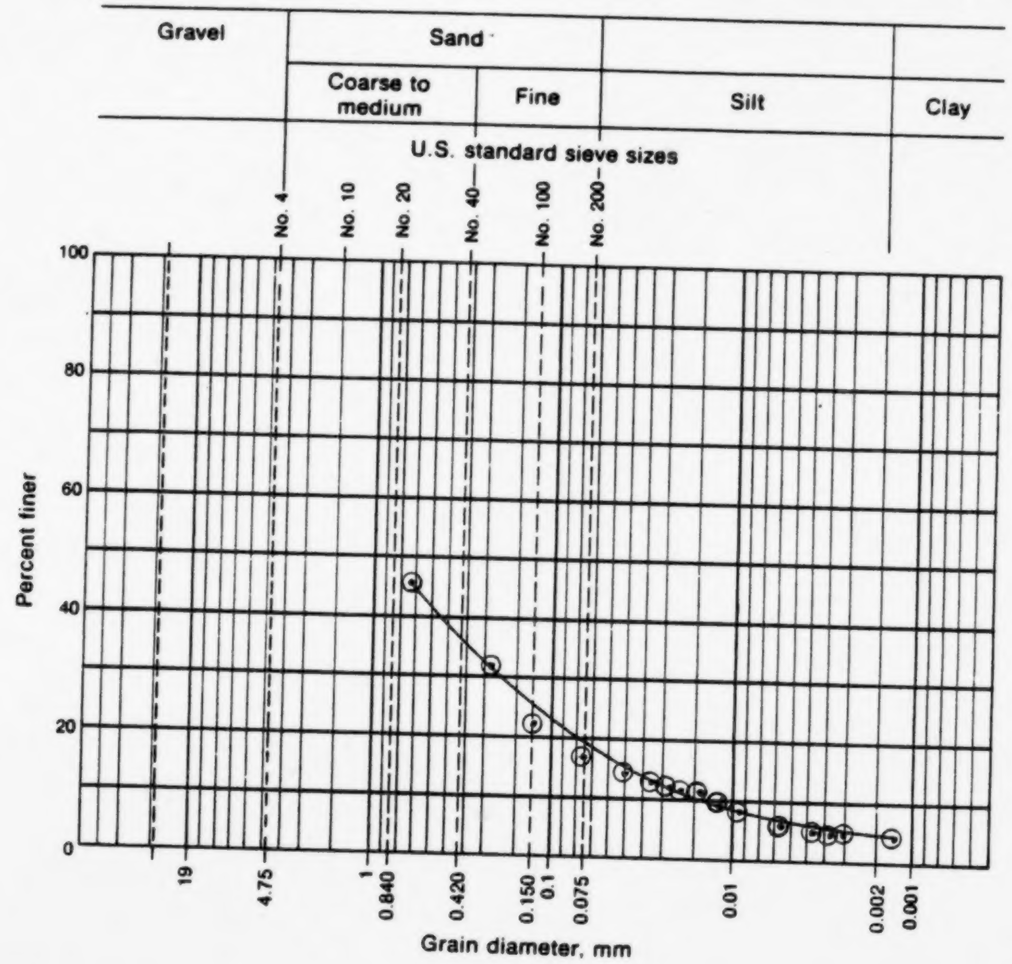
Data Sheet 6

Project HAZCON Job. No. 272-008

Location of Project DOUGLASSVILLE, PA Boring No. ______ Sample No. HZ-203

Description of Soil PFA C1-T1 Depth of Sample ______

Tested By. B. BIRD Date of Testing 11/9/87



Visual soil description ______

Soil classification:

______ System ______

Grain Size Analysis
Hydrometer & Mechanical

Project: Hazcon 203
Date: Nov. 9, 87
Specific Gravity: 2.65
a, corr. factor: 1.00
Wt. of Soil: 50.00
Zero Correction: 2.50
Meniscus Correction: 0.50
Temp. Correction: 0.40
K value: 0.01

Time(min)	R actual	% Finer	L	D(mm)x100	wt.Retnd.	% passing	Meniscus
1.00	9.50	14.80	14.70	5.02	27.48	45.04	10.00
2.00	8.50	12.80	14.82	3.56	7.28	30.48	9.00
3.00	8.00	11.80	14.90	2.92	3.68	23.12	8.50
4.30	7.50	10.80	15.00	2.54	3.01	17.10	8.00
8.00	7.50	10.80	15.00	1.79			8.00
15.00	7.00	9.80	15.10	1.31			7.50
30.00	6.50	8.80	15.20	0.93			7.00
60.00	6.00	7.80	15.20	0.66			6.50
120.00	6.00	7.80	15.20	0.47			6.50
180.00	5.50	6.80	15.30	0.38			6.00
240.00	5.50	6.80	15.30	0.33			6.00
300.00	5.00	5.80	15.40	0.30			5.50
1440.00	5.00	5.80	15.40	0.14			5.50

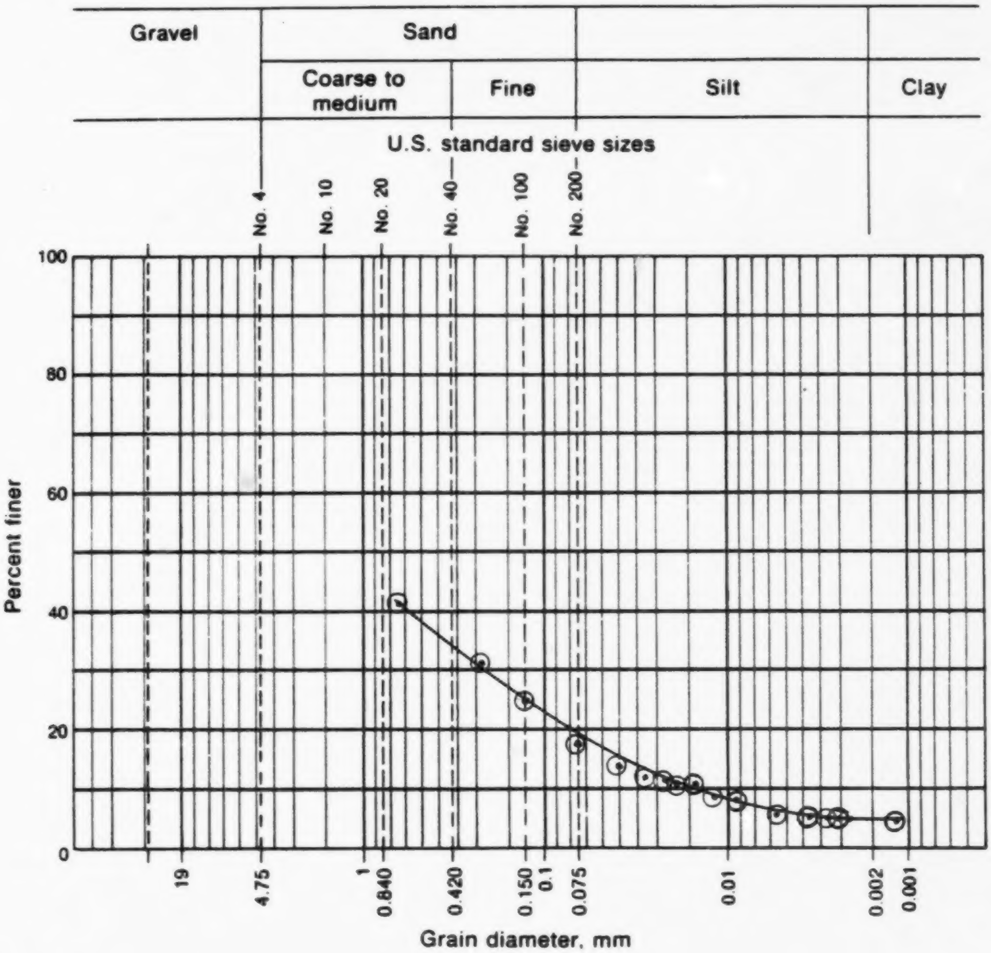
GRAIN SIZE DISTRIBUTION Data Sheet 6

Project HAZCON Job. No. 272-008

Location of Project DOUGLASSVILLE, PA Boring No. Sample No. HZ-209

Description of Soil PFA C1-TZ Depth of Sample

Tested By. B. BIRD Date of Testing 11/9/87



Visual soil description

Soil classification:

System

Grain Size Analysis
Hydrometer & Mechanical

Project:	Hazcon 209
Date:	Nov.9.87
Specific Gravity:	2.65
a. corr. factor:	1.00
Wt. of Soil:	50.00
Zero Correction:	3.00
Meniscus Correction:	2.50
Temp. Correction:	0.40
K value:	0.01

Time(min)	R actual	% Finer	L	D(mm)x100	wt.Retnd.	% passing	Meniscus
1.00	10.00	14.80	14.60	5.01	29.13	41.74	10.50
2.00	9.00	12.80	14.70	3.55	5.60	30.54	9.50
3.00	8.50	11.80	14.80	2.91	3.22	24.10	9.00
4.00	8.00	10.80	14.90	2.53	2.73	18.64	8.50
8.00	8.00	10.80	14.90	1.79			8.50
15.00	7.00	8.80	15.10	1.31			7.50
30.00	7.00	8.80	15.10	0.93			7.50
60.00	6.00	6.80	15.20	0.66			6.50
120.00	6.00	6.80	15.20	0.47			6.50
180.00	6.00	6.80	15.20	0.38			6.50
240.00	6.00	6.80	15.20	0.33			6.50
300.00	6.00	6.80	15.20	0.29			6.50
1440.00	6.00	6.80	15.20	0.13			6.50
							6.50

GRAIN SIZE DISTRIBUTION

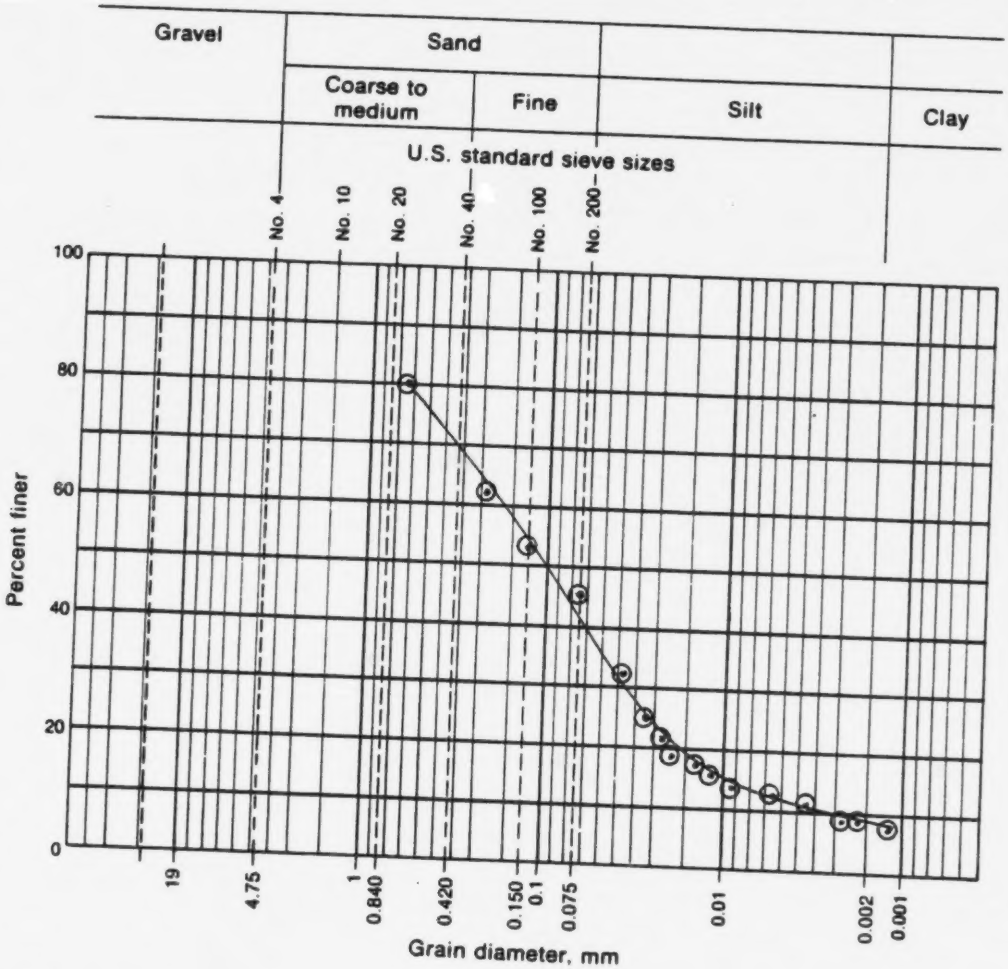
Data Sheet 6

Project HAZCON Job. No. 272-008

Location of Project DOUGLASSVILLE, PA Boring No. ______ Sample No. HZ-259

Description of Soil LAS CI-TI Depth of Sample ______

Tested By. B. BIRD Date of Testing 11/11/87



Visual soil description ______________________________

Soil classification:

______________ System ______________________________

Grain Size Analysis
Hydrometer & Mechanical

Project:	Hazcon 259
Date:	Nov. 11, 87
Specific Gravity:	2.65
a, corr. factor:	1.00
Wt. of Soil:	50.00
Zero Correction:	2.50
Meniscus Correction:	0.50
Temp. Correction:	0.40
K value:	0.01

Time(min)	R actual	% Finer	L	D(mm)x100	wt.Retnd.	% passing	Meniscus
1.00	18.00	31.80	13.20	4.76	10.00	80.00	18.50
2.00	15.00	25.80	13.70	3.43	8.90	62.20	15.50
3.00	13.00	21.80	14.10	2.84	4.40	53.40	13.50
4.00	12.00	19.80	14.20	2.47	3.70	46.00	12.50
8.00	11.50	18.80	14.30	1.75			12.00
15.00	10.50	16.80	14.50	1.29			11.00
30.00	9.00	13.80	14.70	0.92			9.50
60.00	8.50	12.80	14.80	0.65			9.00
120.00	7.50	10.80	15.00	0.46			8.00
180.00	7.00	9.80	15.10	0.38			7.50
240.00	7.00	9.80	15.10	0.33			7.50
300.00	6.50	8.80	15.20	0.29			7.00
1440.00	6.00	7.80	15.30	0.14			6.50

GRAIN SIZE DISTRIBUTION

Data Sheet 6

Project HAZCON

Job. No. 272-008

Location of Project DOUGLASSVILLE, PA

Boring No.

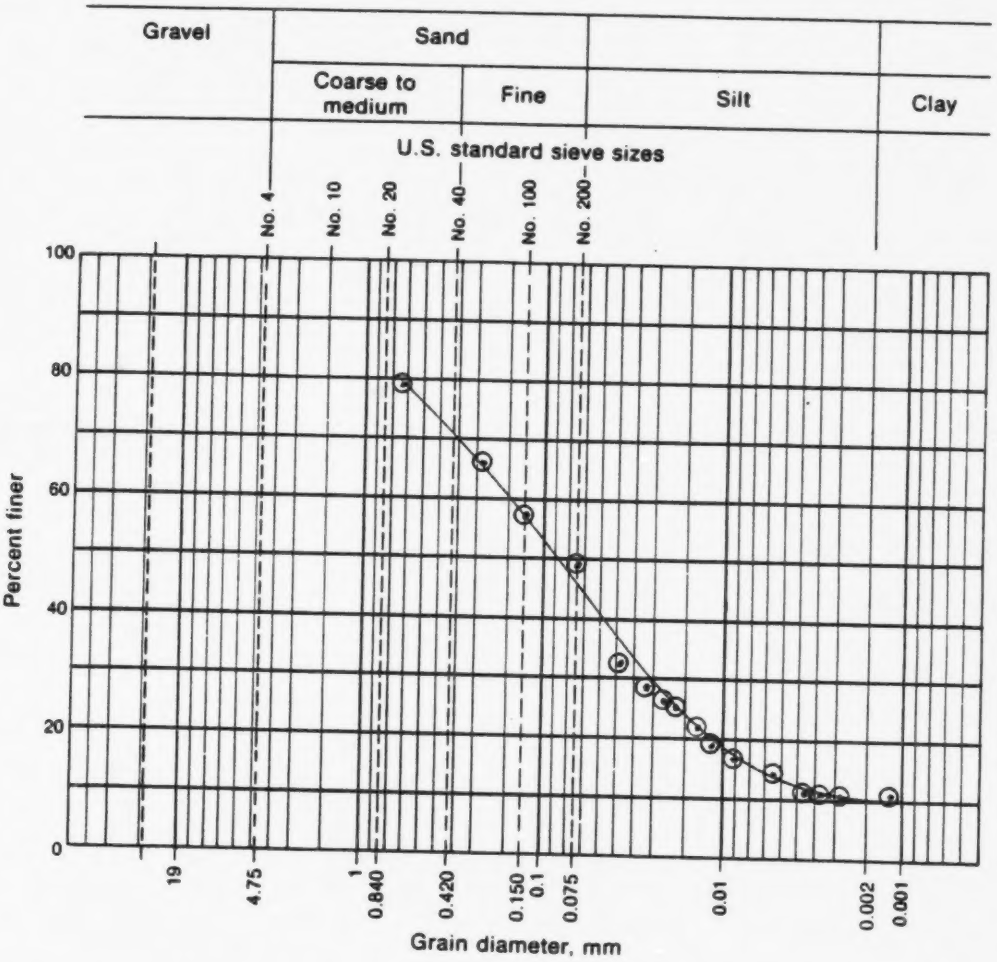
Sample No. HZ-275

Description of Soil LAS CZ-T1

Depth of Sample

Tested By. B. BIRD

Date of Testing 11/11/87



Visual soil description

Soil classification:

System

Grain Size Analysis
Hydrometer & Mechanical

Project:	Hazcon 275
Date:	Nov. 11, 87
Specific Gravity:	2.65
a, corr. factor:	1.00
Wt. of Soil:	50.00
Zero Correction:	3.00
Meniscus Correction:	0.50
Temp. Correction:	0.40
K value:	0.01

Time(min)	R actual	% Finer	L	D(mm)x100	wt.Retnd.	% passing	Meniscus
1.00	19.00	32.80	13.10	4.74	10.07	79.86	19.50
2.00	17.50	29.80	13.30	3.38	7.13	65.60	18.00
3.00	16.00	26.80	13.60	2.79	3.94	57.72	16.50
4.00	15.50	25.80	13.70	2.42	4.01	49.70	16.00
8.00	13.50	21.80	14.00	1.73			14.00
15.00	12.50	19.80	14.20	1.27			13.00
30.00	11.50	17.80	14.30	0.90			12.00
60.00	10.00	14.80	14.60	0.65			10.50
120.00	8.00	10.80	14.90	0.46			8.50
180.00	8.00	10.80	14.90	0.38			8.50
240.00	8.00	10.80	14.90	0.33			8.50
300.00	8.00	10.80	14.90	0.29			8.50
1440.00	8.00	10.80	14.90	0.13			8.50

GRAIN SIZE DISTRIBUTION

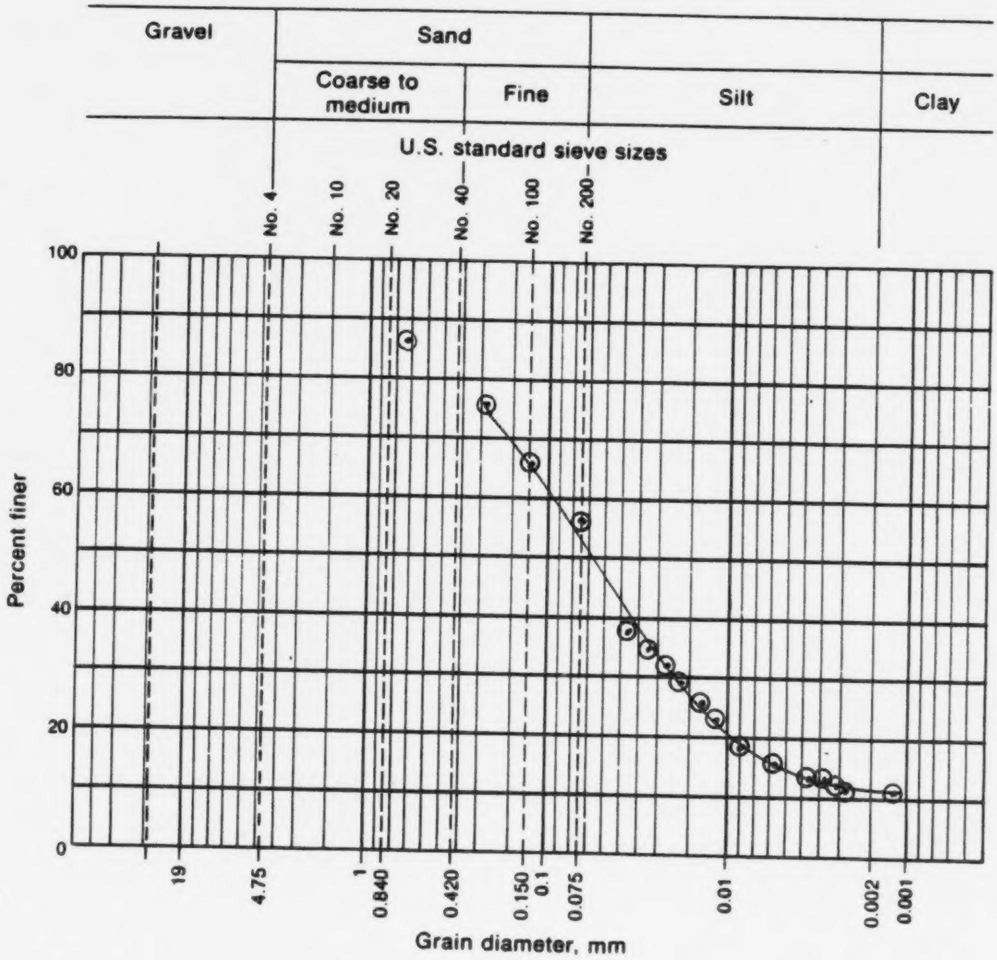
Data Sheet 6

Project HAZCON Job. No. 272-008

Location of Project DOUGLASSVILLE, PA Boring No. ______ Sample No. HZ-287

Description of Soil LAS C4-T1 Depth of Sample ______

Tested By. B. BIRD Date of Testing 11/9/87



Visual soil description ______

Soil classification:

______ System ______

Grain Size Analysis
Hydrometer & Mechanical

Project:	Hazcon 287
Date:	Nov. 9, 87
Specific Gravity:	2.65
a, corr. factor:	1.00
Wt. of Soil:	50.00
Zero Correction:	3.00
Meniscus Correction:	0.50
Temp. Correction:	0.40
K value:	0.01

Time(min)	R actual	% Finer	L	D(mm)x100	wt.Retnd.	% passing	Meniscus
1.00	22.00	38.80	12.60	4.65	6.82	86.36	22.50
2.00	20.00	34.80	12.90	3.33	5.20	75.96	20.50
3.00	18.50	31.80	13.20	2.75	4.67	66.62	19.00
4.00	17.50	29.80	13.30	2.39	5.18	56.26	18.00
8.00	15.50	25.80	13.70	1.71			16.00
15.00	13.50	21.80	14.00	1.27			14.00
30.00	12.00	18.80	14.20	0.90			12.50
60.00	11.00	16.80	14.40	0.64			11.50
120.00	9.00	12.80	14.70	0.46			9.50
180.00	9.00	12.80	14.70	0.37			9.50
240.00	8.50	11.80	14.80	0.33			9.00
300.00	8.00	10.80	14.90	0.29			8.50
1440.00	8.00	10.80	14.90	0.13			8.50

GRAIN SIZE DISTRIBUTION

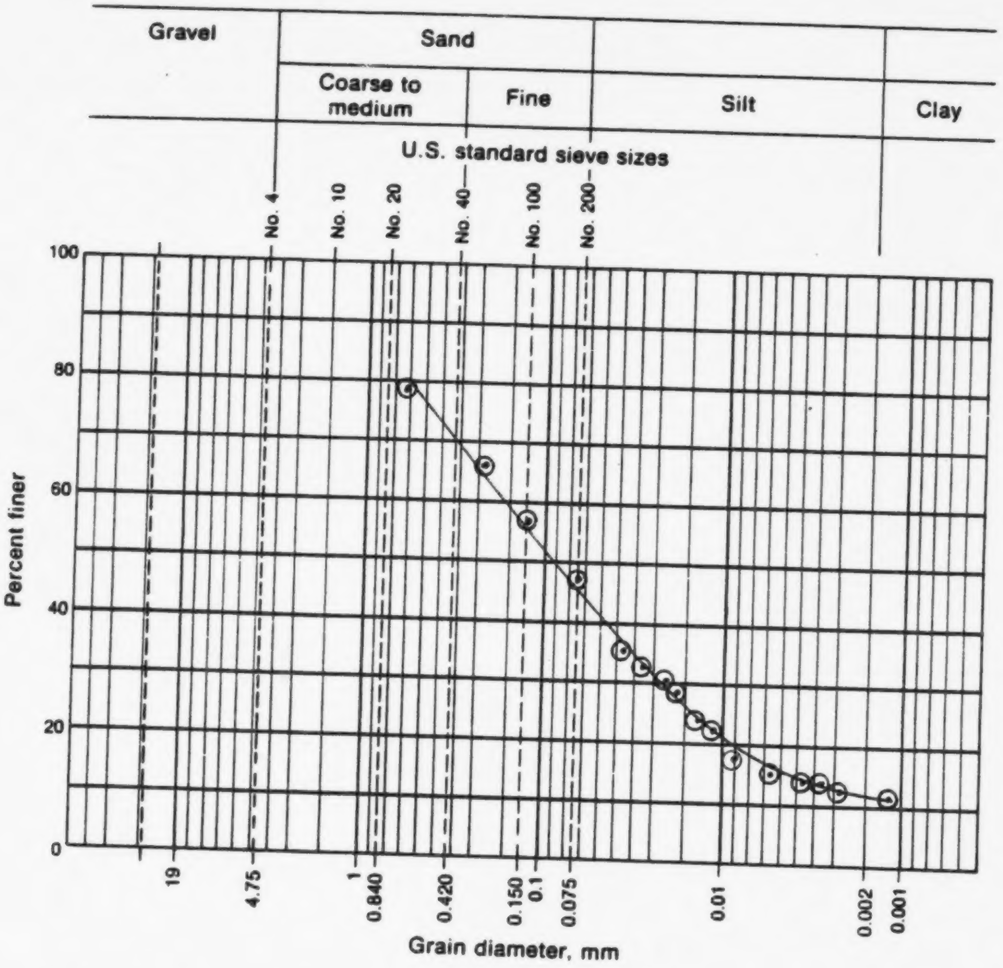
Data Sheet 6

Project HAZCON Job. No. 272-008

Location of Project DOUGLASSVILLE, PA Boring No. ____ Sample No. HZ-293

Description of Soil LAS CS-T1 Depth of Sample ____

Tested By. B. BIRD Date of Testing 11/9/87



Visual soil description ____

Soil classification:

____ System ____

Grain Size Analysis
Hydrometer & Mechanical

Project:	Hazcon 293
Date:	Nov. 9, 87
Specific Gravity:	2.65
a, corr. factor:	1.00
Wt. of Soil:	50.00
Zero Correction:	3.00
Meniscus Correction:	0.50
Temp. Correction:	0.40
K value:	0.01

Time(min)	R actual	% Finer	L	D(mm)x100	wt.Retnd.	% passing	Meniscus
1.00	21.00	36.80	12.80	4.69	10.07	79.86	21.50
2.00	19.00	32.80	13.10	3.35	6.93	66.00	19.50
3.00	18.00	30.80	13.20	2.75	4.39	57.22	18.50
4.00	17.00	28.80	13.40	2.40	4.88	47.46	17.50
8.00	14.50	23.80	13.80	1.72			15.00
15.00	13.50	21.80	14.00	1.27			14.00
30.00	12.00	18.80	14.20	0.90			12.50
60.00	11.00	16.80	14.40	0.64			11.50
120.00	10.00	14.80	14.60	0.46			10.50
180.00	10.00	14.80	14.60	0.37			10.50
240.00	10.00	14.80	14.60	0.32			10.50
300.00	9.00	12.80	14.70	0.29			9.50
1440.00	9.00	12.80	14.70	0.13			9.50

APPENDIX C

AROCLORS AND POLYCHLORINATED BIPHENYLS CONCENTRATIONS IN MATERIALS ASSOCIATED WITH THE HAZCON DOUGLASSVILLE SITE DEMONSTRATION PROJECT

Polychlorinated biphenyls (PCBs) were identified as contaminants at the Douglassville site during preliminary investigations and they were included as one of the contaminants of interest for the HAZCON demonstration project. Several problems were encountered in measuring PCBs in samples associated with the site. This Appendix describes the problems, the approaches taken to overcome the problems, and the results obtained.

Summary

Aroclors are mixtures of PCB congeners. They occur in the contaminated soils at the Douglassville site becuase transformer oils were spilled. Aroclor concentrations in the range of 10 to 50 mg/kg were measured in the contaminated soils although measurements may be reliable only to within a factor of two. Aroclor patterns were not identified in aqueous extracts from untreated soils or from treated soils. Aqueous extracts included TCLP extracts of untreated soils, of treated soils collected in the form of slurries, of treated soils collected as field cores, and aqueous leachates from static leach tests of the field cores. Although Aroclor patterns could not be identified in water extracts (either with or without the buffer used for the TCLP test) chromatographic patterns indicated that halogenated compounds were present in these extracts in significant concentrations in several cases. Several approaches were employed to find out if the halogenated compounds in the extracts were PCBs. Method 680 (gas chromatography/mass spectrometry) is highly specific for PCBs isomers. No PCBs were detected in aqueous extracts using Method 680.

Aroclors in Soils

Aroclor concentrations in the contaminated soils at the Douglassville site were measured using EPA Method 8080, gas chromatography with a packed column and an electron capture detector (ECD). This method measures Aroclor concentrations by comparing instrument response to an unknown injected sample (in this case the soil extract) to the instrument response to standardized chemical grade Aroclors. Peak locations, heights, and areas are compared.

Several criteria must be met to match an Aroclor pattern. The sample pattern must have an exact one-to-one match of all peaks in the Aroclor pattern and the four selected peaks must conform to the criteria for ratios and areas to say that the Aroclor is present. First, the sample chromatogram and the Aroclor standard chromatogram are compared visually to determine that all identifiable peaks in the standard are present in the sample. If there is one-to-one match, then four specific Aroclor peaks are compared. These four peaks must be present in the sample and in the standard at comparable peak ratios and peak areas.

Aroclor 1260 was found in all contaminated untreated soils taken from the Douglassville site and Aroclor 1248 was found in soils from the Processing Facility and from Lagoon South.

Some quality control problems were encountered in analyzing the soils using Method 8080. Samples from the Drum Storage Area exhibited normal surrogate recovery. Samples from the other areas exhibited abnormally high surrogate recoveries. The very high apparent surrogate recoveries were attributed to the high level of ECD active compounds (typically halogenated compounds, although this can include phthalates and aromatics) in the samples leading to constructive interference with the surrogate.

The matrix spike and matrix spike duplicate recoveries were highly variable because the pesticides that were spiked were obscured by components in the sample matrix.

No Aroclors were found in the background soil. This indicates that there is little chance that false positive results were obtained and does indicate that Aroclors were present. The high surrogate spike recoveries and

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variable matrix spike results indicate that reported Aroclor concentrations may be in error by a factor of two.

Aroclors and PCBs in TCLP Leachates and Water Extracts

Aroclor patterns could not be identified in aqueous extracts of soils, or of treated soils. Aqueous extracts included TCLP leachates, and water extracts from static leach tests. But, several extracts exhibited chromatographic peaks at levels that represented significant concentrations of ECD-sensitive compounds. Based on their relative retention times these peaks were considered as possible PCB congeners.

Wide Bore Capillary Column Test

One attempt to improve correlation of TCLP extract results with Aroclor standards was to substitute a wide bore capillary column. Fourteen TCLP extracts were selected to represent the samples sites in duplicate and include background soils. Method 8080 employs a mixed phase packed column coupled to the ECD to identify Aroclors by retention time and peak ratio. The QAPP stated that if resolution problems were encountered using the packed column, the wide bore capillary would be employed to try to improve resolution. The fourteen TCLP extracts were analyzed using the wide bore capillary column. The wide bore capillary method yielded even more complex chromatograms than had been observed from the packed column and no Aroclor pattern was identified.

Water TCLP Extracts

Aroclors may not have been found in TCLP extracts because the sodium acetate buffer used in the TCLP extract reduced the solubility of PCBs in the extract. The relative solubilities of the PCBs in the organic solvent used for the soil extract may be different than the relative solubilities of PCBs in water leading to changes in the Aroclor pattern. Three TCLP extracts were carried out without the acetate buffer on soil samples known to have high concentrations of Aroclor 1260 to see if the sodium acetate buffer was reducing the solubility of PCBs and if the Aroclor pattern was evident in a water extract. These were referred to as "TCLP water extracts". Identifiable Aroclor patterns were not found in these extracts.

Aroclor Spike

Background soil was spiked with 500 ppm of Aroclor 1260 and subjected to the TCLP extraction. The Aroclor pattern could not be identified in the extract. This result raises an important question. If we know that a quantifiable amount of intact Aroclor was in the sample, and yet it could not be successfully extracted using the TCLP leachate process, this appears to indicate that the Aroclor is not soluble in the TCLP extract.

It was considered likely that if the the ECD was detecting significant amounts of halogenated compounds, it was possible that some of these constituents were PCBs. The only method to detect specific PCBs is Method 680.

Method 8080 Screen

The chromatographic patterns of TCLP extracts measured using Method 8080 varied widely in intensity. Several of the patterns were determined to be at low non-quantitative levels, and were therefore not candidates for further testing. Chromatographic patterns for aqueous extracts from other sources indicated high enough concentrations of possible PCB isomers and were selected for analysis using Method 680. The static leachate samples were also analyzed by 8080, and yielded the same types of results. All of the leachates, were grouped into three categories: samples with no detectable compounds at all; those with detected compounds at quantifiable levels which required further analysis to determine if PCBs were present; and those which showed some definite peaks, but at non-quantifiable levels and therefore required no further analysis.

Method 680 GC/MS Test for PCB Isomer Groups

EPA Method 680 employs gas chromatography/mass spectrometry (GC/MS) to identify biphenyl isomer groups, that are characterized by the number of chlorine atoms substituted on the biphenyl group. This method was applied to TCLP extracts and to static leachates that exhibited significant peaks in the 8080 analysis.

Although the Method 8080 patterns indicated that halogenated compounds were present, Method 680 tests indicated that these compounds were not polychlorinated biphenyls.

Method 680 is very specific for detecting groups of PCB isomers. Aroclor 1260 is made up primarily of biphenyl groups substituted with 5,6 or 7 chlorine atoms with smaller fractions of the biphenyl groups substituted with 8 or 9 chlorine atoms. None of these were detected in any of the samples. It is not, therefore, possible to correlate the detection limits for each specific isomer group to a "minimum" PCB detection limit. The more heavily chlorinated biphenyls, for instance, have higher detection limits than the mono- or dichlorobiphenyls. Therefore, the detection limits for the 680 method must be considered species specific.

APPENDIX C

CHARACTERIZATION OF HAZCON SAMPLES BY SCANNING ELECTRON MICROSCOPY, OPTICAL MICROSCOPY, AND X-RAY DIFFRACTION

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CHAPTER I

INTRODUCTION

Twenty-two (22) samples, including soils slurries, and solidified cores were received. They were examined by various techniques to characterize their morphology and phase composition.

EXPERIMENTAL PROCEDURE

All the samples were characterized using scanning electron microscopy (SEM), x-ray diffractometry (XRD), and optical microscopy (OM). Energy dispersive x-ray spectrometry (EDXRA) was also performed on some samples.

Small chips, few mm to a cm in size, were broken off from the samples and mounted on aluminum stubbs with an adhesive cement. Two specimens were prepared from each sample, one for SEM observations, which was coated with gold and the other for EDXRA, which was coated with carbon. A fresh surface was always examined. X-ray diffractometry was performed on finely crushed powder of each sample. The high concentration of organics in some of the samples, however, interfered with proper crushing. The same powdered sample was used for optical observations.

Scanning electron microscopy was carried out with an AMR 1200 SEM; EDXRA was performed with an attached Ortec EDXRA system. Several EDXRA plots are included in the report. In an EDXRA plot the horizontal axis is energy, in kilo electron volts and the vertical axis in intensity, in counts per second. In all the plots included here the vertical scale is logarthmic. High quality SEM photomicrographs could not be obtained from several samples because organic-rich nature of the samples prevented a good conductive coating to form during sputtering. The XRD runs were made with a Philips x-ray diffractometer. The samples were run from 4 to 70 degrees two theta, at one degree two theta per minute. Quartz, which is found in all the samples, was used as an internal standard.

CHAPTER II

OBSERVATIONS OF SAMPLES FROM THE LAGOON NORTH AREA

HZ-075 (Soil)

Scanning electron microscopy of this sample was difficult because of charging. Quartz was observed but optical microscopy suggests that it was less abundant than in the other soil samples examined in this study. Brownish colored aggregates, composed of small transparent particles, are very common in this sample.

The mineral phases found after x-ray diffraction analysis are listed in Table II.1. Illite peaks are the strongest and some calcite is present. A broad hump is present in the XRD pattern over the 15 to 25 degree two theta range. It is likely to be due to poorly crystalline, glassy material. Several unidentified peaks unlikely to be due to clay mineral (e.g., 8.62 A), are also observed.

HZ-619 (Slurry)

SEM analysis was again complicated by charging. At low magnification, very little crystalline material was evident. Under the optical microscope, however, angular quartz is observed. The brownish colored aggregate, common in the soil samples, are also abundant.

The phases identified from the XRD pattern are listed in Table II.1. Several quartz peaks are present and very intense suggesting that quartz is volumetrically important in this sample. This corroborates the optical observation, but differs from the observations made on the

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TABLE II.1

Mineral Phases Identified in X-Ray Analyses - Lagoon North

SAMPLE	TYPE	PHASES PRESENT*
HZ-075	Soil	Illite, quartz and calcite.
HZ-619	Slurry	Quartz, portlandite, illite, ettringite, C_3S and gypsum.
HZ-443	Core	Quartz, portlandite, calcite, ettringite, gypsum, and illite.
HZ-454	Core	Quartz, portlandite, illite, ettringite, C_3S and gypsum.

*The phases are not listed according to abundance.

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soil sample from which the slurry was made where quartz was determined to be a minor component. This apparent contradiction could be due to faulty.sampling. Illite is also found in the sample. Among the newer phases, portlandite, ettringite, unhydrated C_3S, and gypsum can be seen. The amount of portlandite is low compared to the other slurry sample. The 0.858 nm peak, observed in the soil, is also observed in this sample.

HZ-443 and HZ-454 (Core)

It was also difficult to perform SEM work with the core samples because of charging. At low magnification, pores of different sizes could be observed in HZ-443, but are less abundant than other core samples. In other areas, the sample appears quite dense (Plate II.1). It is probably the C-S-H phase, which has a crude layered structure. Under the optical microscope, the sample appears similar to other cores but the brownish colored aggregates of smaller transparent grains are more common than in other samples. Quartz grains were observed, as well as a few smaller opaque grains.

The XRD pattern shows that quartz and illite peaks are quite prominent, in contradiction to the small amount observed in the soil which is present in the cores. These phases are coming from the soil and form an appreciable fraction of the core. Portlandite is very common and most of its major peaks can be identified. Ettringite is also conspicuous, and some gypsum may also be present. Unhydrated C_3S, which is common in many other core samples, is not observed.

HZ-454 does not appear very different from HZ-443 in the SEM. Optical microscopy of the sample indicates a small amount of quartz compared to other cores, but agrees with the observation that the soil itself contains very little quartz. The brownish colored aggregate, composed of smaller transparent grains are very common. Sometimes smaller opaque inclusions are present within the aggregate.

One EDXR analysis is available from HZ-454 (Fig. II.1). The elements detected are, in order of decreasing abundance, Ca, Si, Al, Fe, S, K, Ti and Mg. As such a high concentration of Ca is not expected from a soil containing mostly illitic clay, the intense Ca peak must have come from the binder. The binder is then a CaO based agent, similar to Portland cement.

The XRD pattern of HZ-454 is significantly different from the other cores of this group, HZ-443. The proportions of quartz and illite, coming from the soil, are different. More quartz is present in this sample than the other core. Among the newly crystallized phases, portlandite and ettringite can be seen but in significantly reduced quantities. Unhydrated C_3S and gypsum are present. Some peaks can be traced attributed to the soil, such as the one around 0.76 nm and at 0.86 nm.

HZ-443

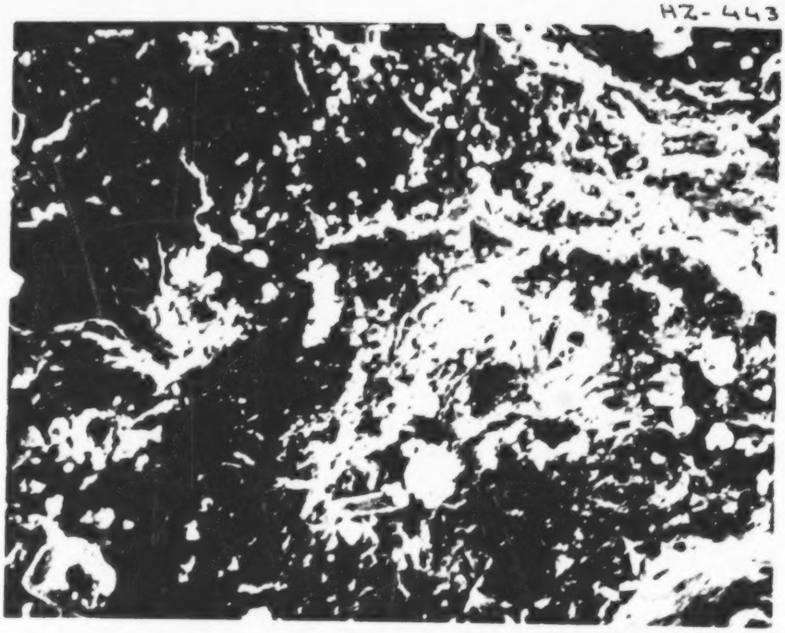

Plate II.1.

HZ-454

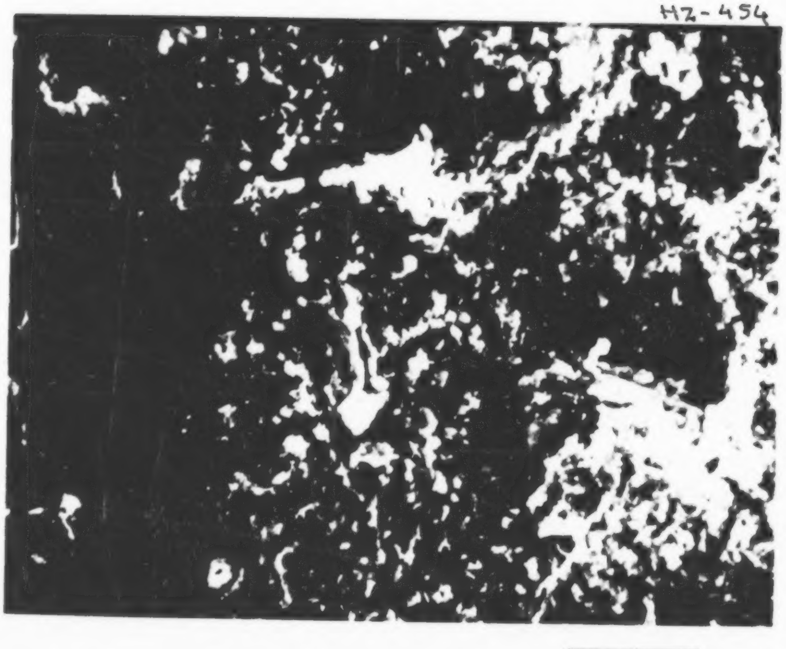

Plate II.2

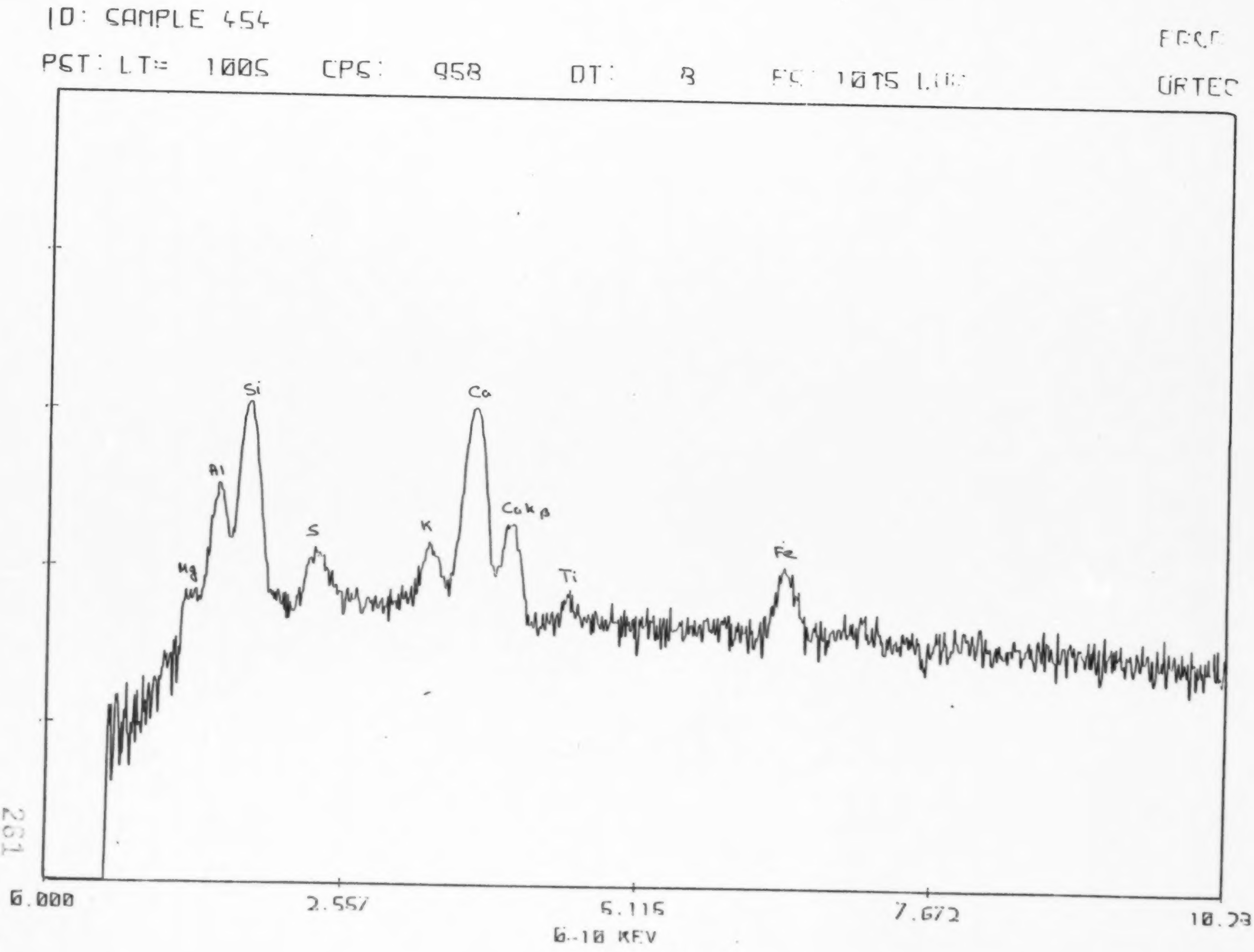
ID: SAMPLE 454
PST: LT= 100S CPS: 958 DT: 8 FS: 10TS LIN
EG&G
ORTEC
Mg
Al
Si
S
K
Ca
Ca kβ
Ti
Fe
0.000
2.557
5.115
7.672
10.23
0-10 KEV

FIG. II.1

CHAPTER III

OBSERVATION OF SAMPLES FROM THE LAGOON SOUTH AREA

HZ-274 (Soil)

Scanning electron microscopy could not be done extensively on this sample because of charging. Some of the soil particles are shown in Plates III.1 and 2. These particles are mainly composed of very fine grained clay minerals, the sheet-like structure of which can be easily discerned. A rhombohedrally shaped calcite grain can be seen in plate III.1, easily identifiable by its characteristic cleavage. Under the optical microscope, large, angular quartz grains are commonly observed. Brownish colored aggregates, composed of smaller transparent particles are also present. These aggregates are much smaller than the particles shown in Plates III.1 and III.2, but are likely to be their broken fragments.

The phases identified from the XRD pattern are listed in Table III.1. Quartz peaks are very intense, suggesting that it is a major constituent of the soil. Illite is also volumetrically significant and some kaolinite may be present. The broad hump, present in the 15 to 25 degree two theta range of the XRD pattern of many samples, is absent in this pattern suggesting that the glass content is low. Several unidentified peaks are observed.

TABLE III.1

Mineral Phases Identified in X-Ray Analyses - Lagoon South

SAMPLE	TYPE	PHASES PRESENT*
HZ-274	Soil	Quartz, illite and kaolinite.
HZ-384	Core	Quartz, portlandite, illite, ettringite, and C_3S.
HZ-390	Core	Quartz, portlandite, illite, ettringite, calcite and C_3S.
HZ-403	Core	Quartz, portlandite, illite, ettringite, calcite, gypsum and C_3S
HZ-422	Core	Quartz, portlandite, illite, ettringite, calcite, gypsum, C_3S

*The phases are not listed according to abundance.

HZ384, HZ-390, HZ-403 and HZ-422 (Cores)

Scanning electron microscopy of HZ-384 showed that the sample is locally dense but trapped air bubbles and other pores are abundant (Plates III.3 and 4). Air bubbles produce spherically shaped pores with smooth walls, and are sometimes connected by large fractures (Plate III.4). The C-S-H phase appears structureless. Optical microscopy shows that HZ-384 is similar to the other cores but more of the smaller opaque particles may be present in this sample. They are highly irregular in shape.

Table III.1 shows the phases present in HZ-384. Quartz has the most intense peaks indicating it comprises a significant portion of the sample; this observation agrees with the observations made on the soil. Illite, also coming from the soil, can be identified in the XRD pattern. Portlandite and ettringite peaks are very pronounced among the newly forming phases. Some unhydrated C_3S can also be identified, the amount is higher than expected in a hydrated Portland cement with a moderate water to cement ratio (e.g., $w/c \sim 0.4$). Table 5.1 (in the main report) which summarizes Hazcons targeted operating conditions, indicates that the vendor attempts to achieve a water to solids ratio of approximately 0.2.

SEM photomicrographs are not available from HZ-390, although the sample appeared very similar to HZ-384 in the SEM. Quartz grains, angular in shape, are common in HZ-390 under the optical microscope. Angular, irregularly shaped opaque particles, observed in HZ-384, can also be seen.

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A 200 micrometer region in HZ-390 was analyzed by EDXRA (Fig. III.1). The elements present, in decreasing order of abundance, are Ca, Si, Al, Fe, K, S, Cl and Ti. The clay minerals, quartz and calcite probably provided most of the Si, Al, K, Ti, Fe and part of the Ca. Most of the Ca was contributed by the binding agent. S and Cl presumably come from the oil and/or the binding agent.

The XRD pattern of HZ-390 is similar to that of HZ-384 and the phases present are the same except calcite peaks are more evident in this sample (Table III.1). The relative intensities are, however, different; HZ-390 contains less quartz and more portlandite. The amount of ettringite is similar.

At low magnifications, in the SEM, HZ-403 appears similar to the other cores in this group. Pores are quite common and are of two types, an air bubble produced pores like those previously discussed and also irregularly shaped pores produced when there is insufficient hydration product to fill sample soil spaces at a particular site. The C-S-H has a layered structure (Plate III.5 and 6). Locally, the shells of broken air bubbles can be seen (A. Plate III.5). In some areas, the fiber-like material seen in the soil (Plate III.1) can also be seen in the core (Plate III.7). Optical microscopy indicates that quartz grains may be more abundant in HZ-403 than other cores from this group. Opaque particles are also found. They have a highly variable size distribution.

The phases present in HZ-403, as evidenced from the XRD pattern, are the same as the last sample, HZ-390 (Table III.1). The relative proportions are also similar. Quartz is most abundant, followed by portlandite; ettringite is common as is unhydrated C_3S. Some gypsum may also be present. Unidentified peaks (e.g., 0.86 nm), found in the soil sample from this area and other areas of study, can be seen in the pattern.

Scanning electron microscopy of HZ-422 shows it is morphologically similar to HZ-384, HZ-390 and HZ-403 (50 X, Plate III.8). Pores are abundant and some are due to trapped air bubbles. In other areas the sample is dense. Plate III.9 shows some form of massive C-S-H. EDXRA indicated it is calcium alumino-silicate. In other parts of the photomicrograph, a layered structure can be seen in the C-S-H. Hexagonal, plate-like crystals are also observed in some regions. The morphologies found in this sample are typical of those observed in Portland cement. Optically, HZ-422 is not very different from the other cores. Calcite can be identified in the sample by its characteristic cleavage and birefringence.

The XRD pattern and the phases present in HZ-422 are similar to the other cores of the group (Table III.1). The quartz peaks are the most intense, suggesting it is volumetrically the dominant mineral in the core. Some illite can be identified but it is significantly less than observed in the other cores. Portlandite and ettringite are very common. Gypsum is more readily identifiable than in other cores. Several peaks could not be identified, some also appearing in XRD patterns from the soil.

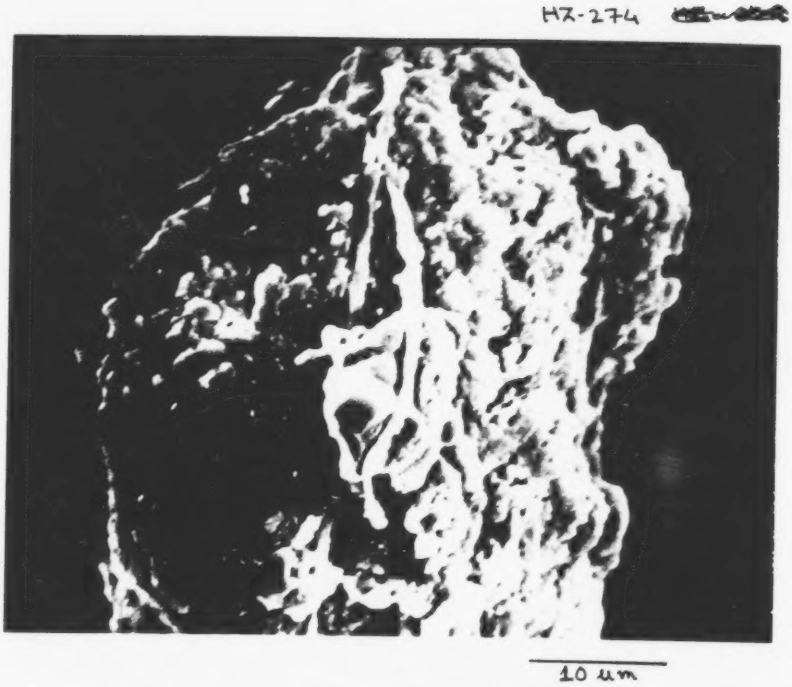
HZ-274 [redacted]
10 um

Plate III. 1.

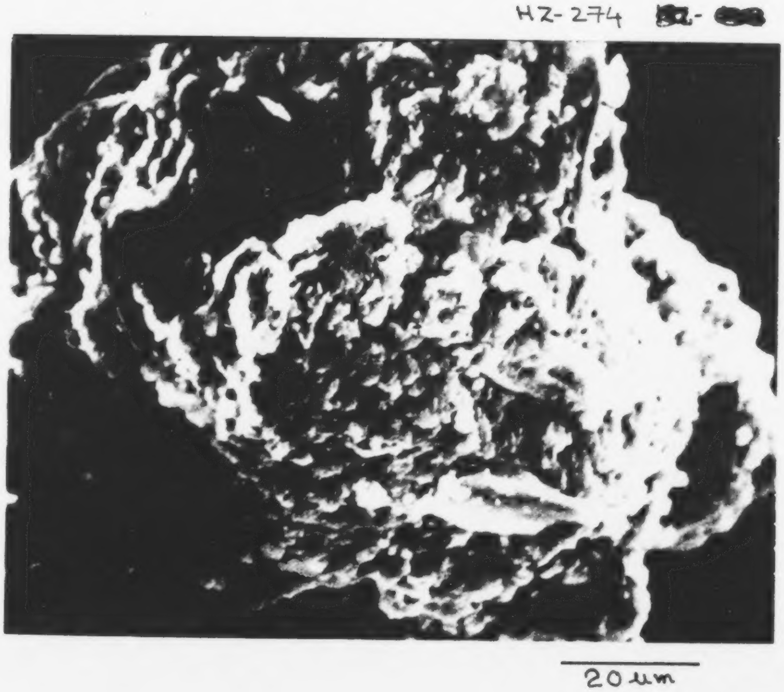
HZ-274 [redacted]- [redacted]
20 um

Plate III. 2

HZ-384

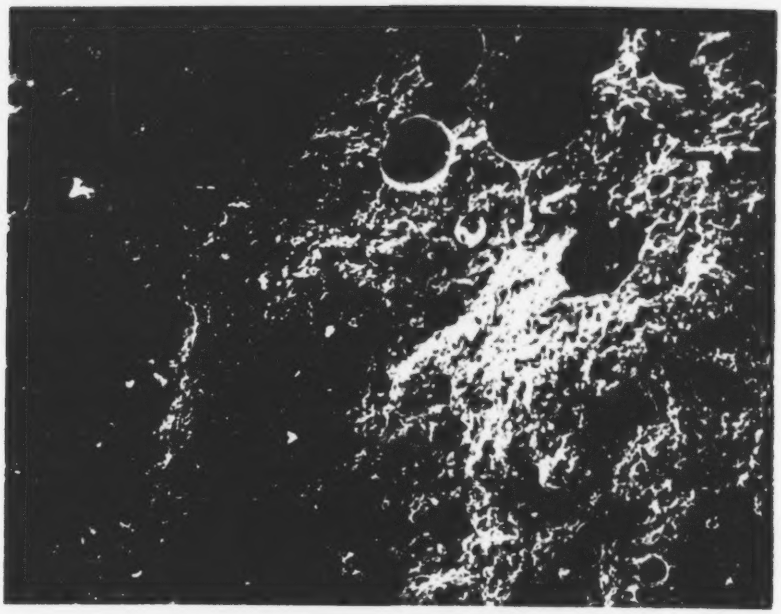

Plate III. 3

HZ-384

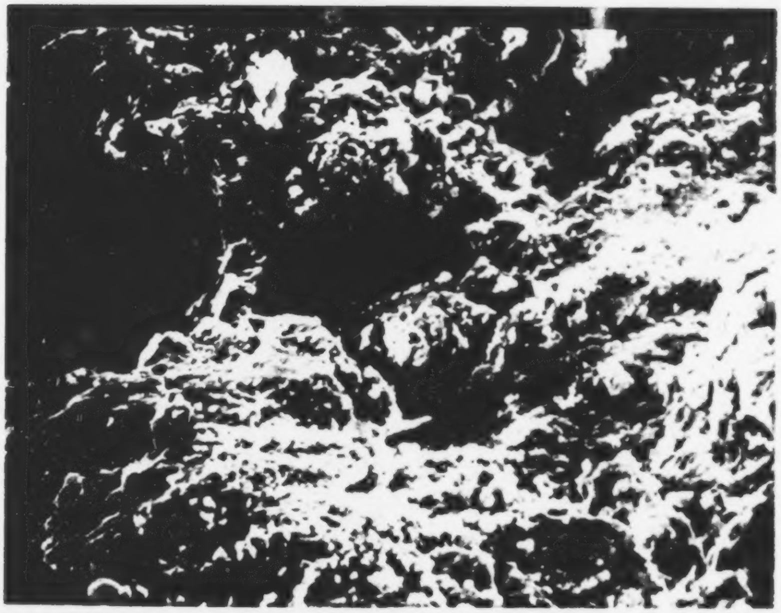

Plate III. 4

HZ-403

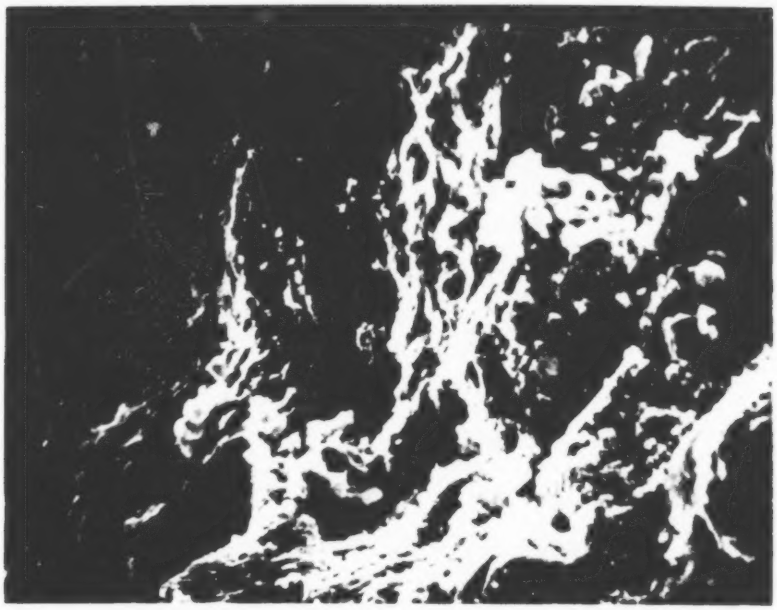

Plate III.5

HZ-403

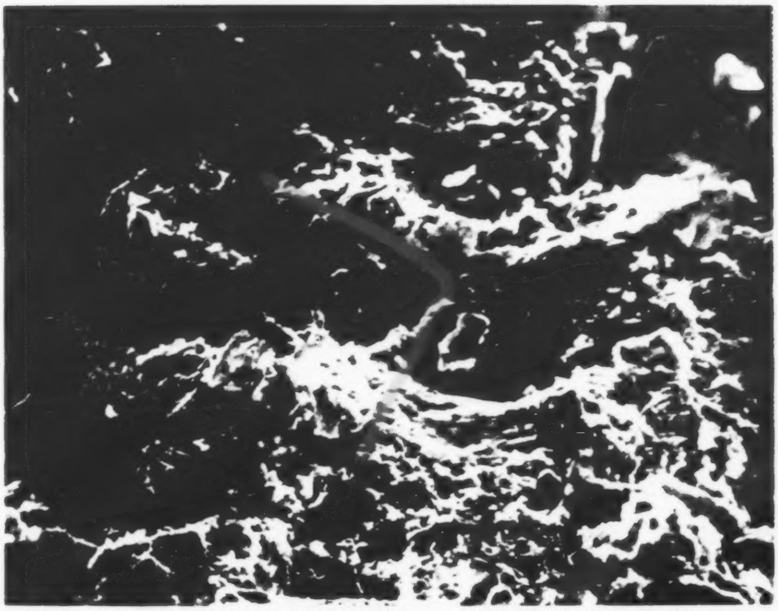

Plate III.6

H2-403

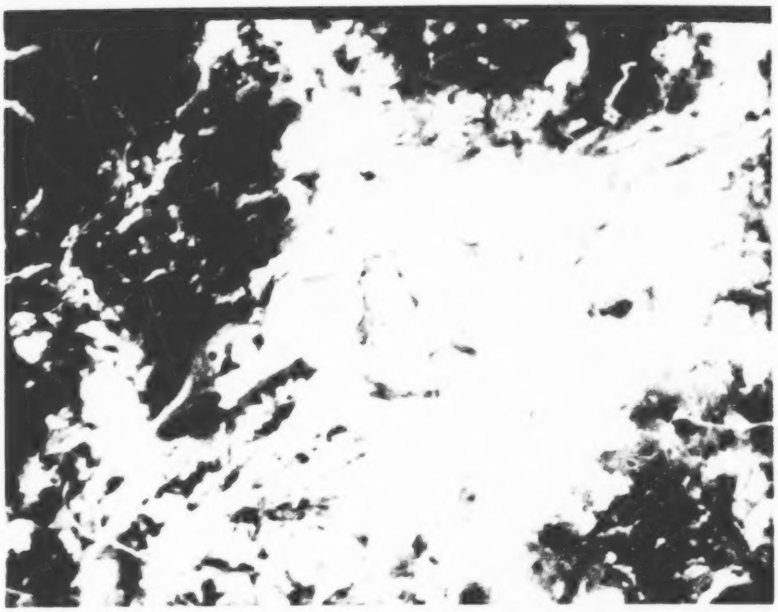

Plate III 7

HZ-422

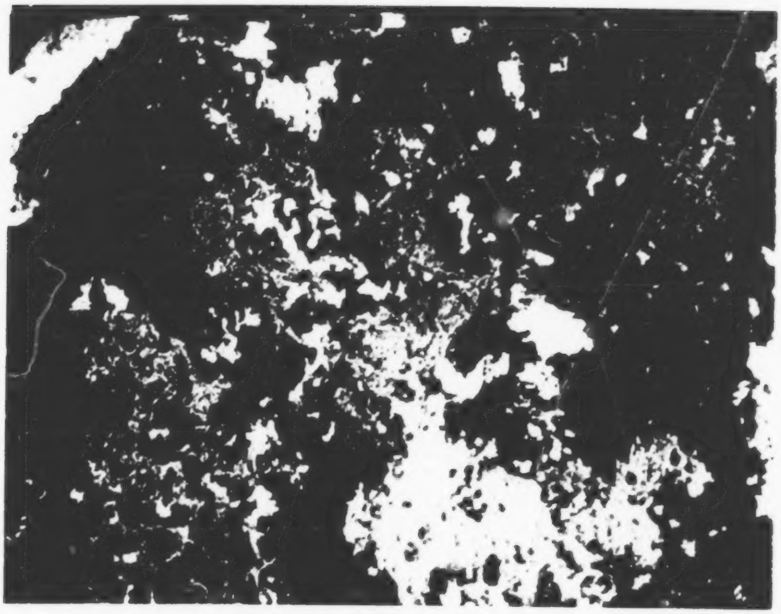

Plate III.8

HZ- 422

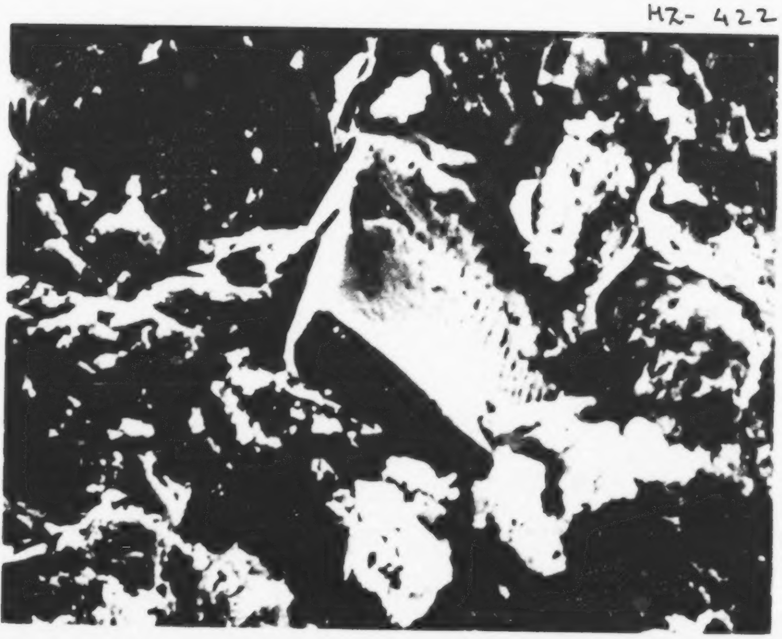

Plate III.9

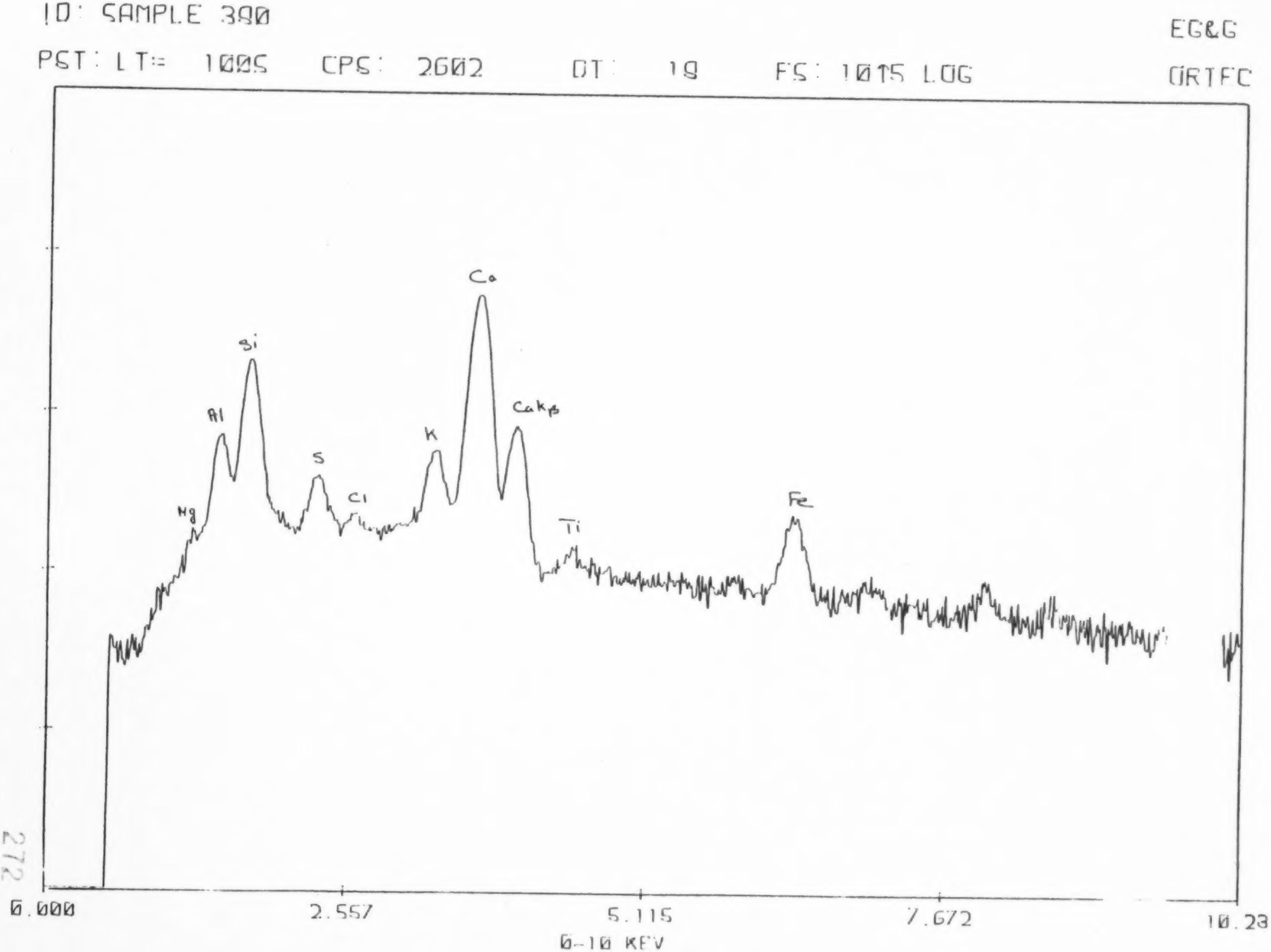
ID: SAMPLE 390
EG&G
PST: LT= 100S
CPS: 2602
DT: 19
FS: 1015 LOG
ORTEC
Mg
Al
Si
S
Cl
K
Ca
Cakβ
Ti
Fe
0.000
2.557
5.115
7.672
10.23
0-10 KEV

FIG III. 1

CHAPTER IV

OBSERVATIONS OF SAMPLES FROM THE PROCESSING FACILITY AREA

HZ-220 (Soil)

In the scanning electron microscope the sample appears to be composed mostly of angular quartz grains and clay mineral aggregate. High quality photomicrograph could not be obtained from this sample because of charging. Optical microscopy also shows that abundant angular quartz grains are present as well as brownish colored aggregates of small transparent grains common in other soil samples.

An EDXRA spectrum of the soil is shown in Fig. IV.1. Apart from Si, Al, and Fe, which can be common in soils, Ca, K and Ti are observed. K is presumably coming from illitic clay. Ca should come from smectite-like clay minerals but smectite is not seen in the XRD pattern.

The phases present in the XRD pattern of the soil (HZ-220) are listed in Table IV.1. Quartz peaks are very intense and most of them can be identified in the pattern, suggesting that quartz is volumetrically an important constituent of the soil. The clay minerals kaolinite and illite are present in the soil; both are non-expandable clays.

HZ-486 and HZ-500 (Cores)

Abundant pores can be observed in HZ-486 by SEM (Plate IV.1 and 2). These pores are somewhat irregular in shape, unlike those associated with trapped air bubbles, and appear interconnected. A few large grains, bounded by well developed crystal faces, can be seen in the photomicrographs.

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TABLE II.1

Mineral Phases Identified in X-Ray Analyses -
Processing Facility Area

SAMPLE	TYPE	PHASES PRESENT*
HZ-220	Soil	Quartz, kaolinite, illite, calcite.
HZ-486	Core	Illite, quartz, portlandite, ettringite, calcite, C_3S, C_2S, magnetite.
HZ-500	Core	Quartz, portlandite, calcite, ettringite, gypsum, C_3S, CAH

*The phases are not listed according to abundance.

CAH - calcium aluminum hydrates.

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(EDXRA indicated that these grains are calcium alumino-silicates). Hexagonal plate-like crystals are often seen (Plate IV.3), and appear in most cases to grow into the pores. The photomicrograph also shows the nature of the C-S-H phase. Optical microscopy indicates that clean, angular quartz grains are quite common. Brownish colored aggregates of smaller grains are sometimes observed. Some irregular shaped opaque grains can also be found in the sample.

An EDXR analysis from a 200 micrometer area of the sample HZ-486 shows that the elements present, in order of decreasing abundance, are Ca, Si, Al, Fe, S, K and Cl. The analysis is typical of what would be expected of a sample with a CaO based binding agent.

The phases present in the XRD pattern are tabulated in Table IV.1. Portlandite ($Ca(OH)_2$) peaks are very pronounced in the core HZ-486. Several ettringite (calcium aluminum sulphate hydrate) peaks can also be identified in the pattern suggesting that it is a common constituent. Some calcite is also present in the pattern, which may be from the soil itself or by carbonation of portlandite. Peaks corresponding to the unhydrated clinker phases C_3S (2.78-2.77 A) and C_2S (2.18 A) can be seen in the pattern. The intensity of the peaks suggests that an appreciable amount of the clinker phases has remained unhydrated. The illite peaks are also quite strong.

HZ-500 are fewer pores than HZ-486. Plate IV.4 (2,000 X) shows some layered material in the middle left, which is probably massive portlandite. The remainder may be C-S-H. The next photomicrograph (Plate IV.5, 2,000 X) illustrates less well defined layered materials and some hexagonal crystals growing adjacent to a large pore. Optically, the sample appears similar to HZ-486 but contains more of the smaller opaque particles. Quartz is common and the brownish colored aggregates of smaller transparant grains are present.

Tbe phases identified form the XRD patterns are shown in Table IV.1. The XRD pattern of HZ-500 differs from that of HZ-486; the peak intensities of the former are low compared to the latter. Among the clay minerals, only illite is observed, with kaolinite being absent. Quartz, however, is quite common, and so is calciate. Portlandite and ettringite are also found. Some C_3S is also observed but C_2S is absent, indicating a higher degree of hydration compared to HZ-486. Gypsum can also be identified; the binding agent probably contains more gypsum than is found in ordinary Portland cement.

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HZ-486

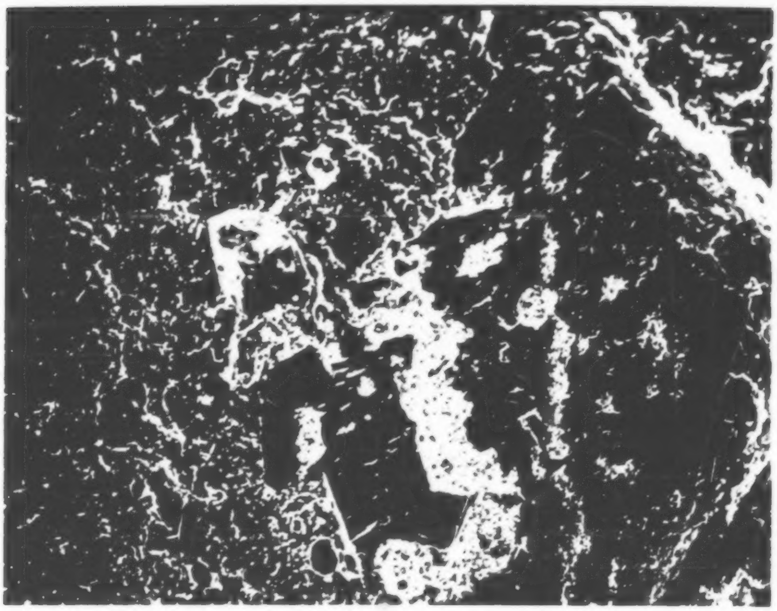


Plate IV. 1

HZ-486

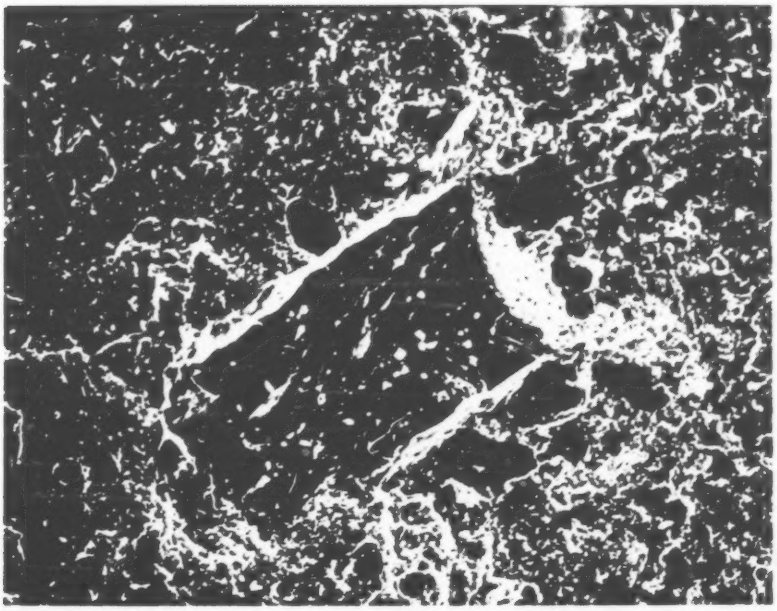


Plate IV. 2

HZ-486

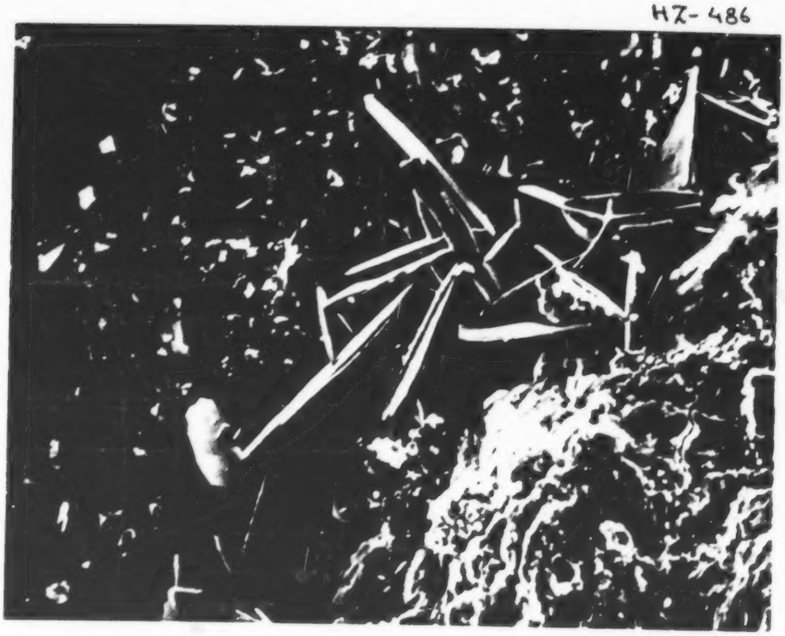


Plate IV. 3

HZ-500

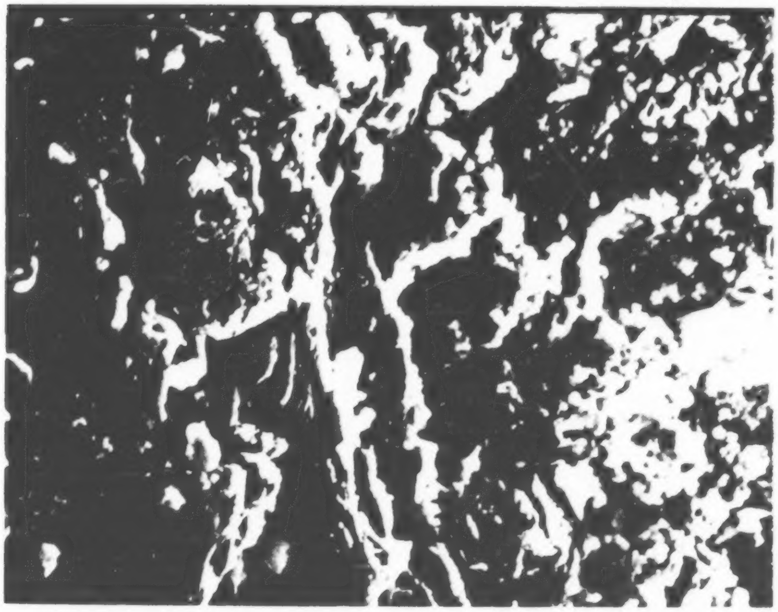


Plate IV. 4

HZ-500

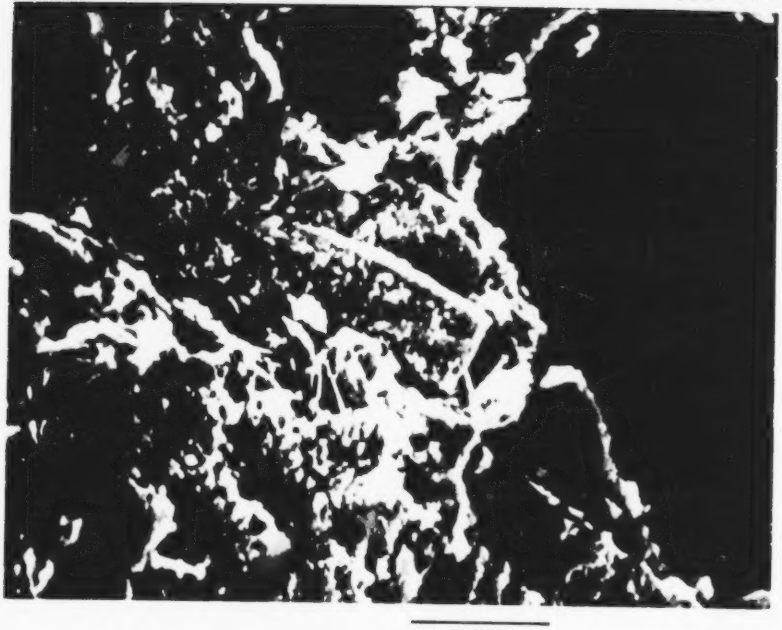


Plate IV.5

ID: SAMPLE 220 EG&G

PST: LT= 100S CPS: 477 DT: 4 FS: 10TS LOG ORTEC

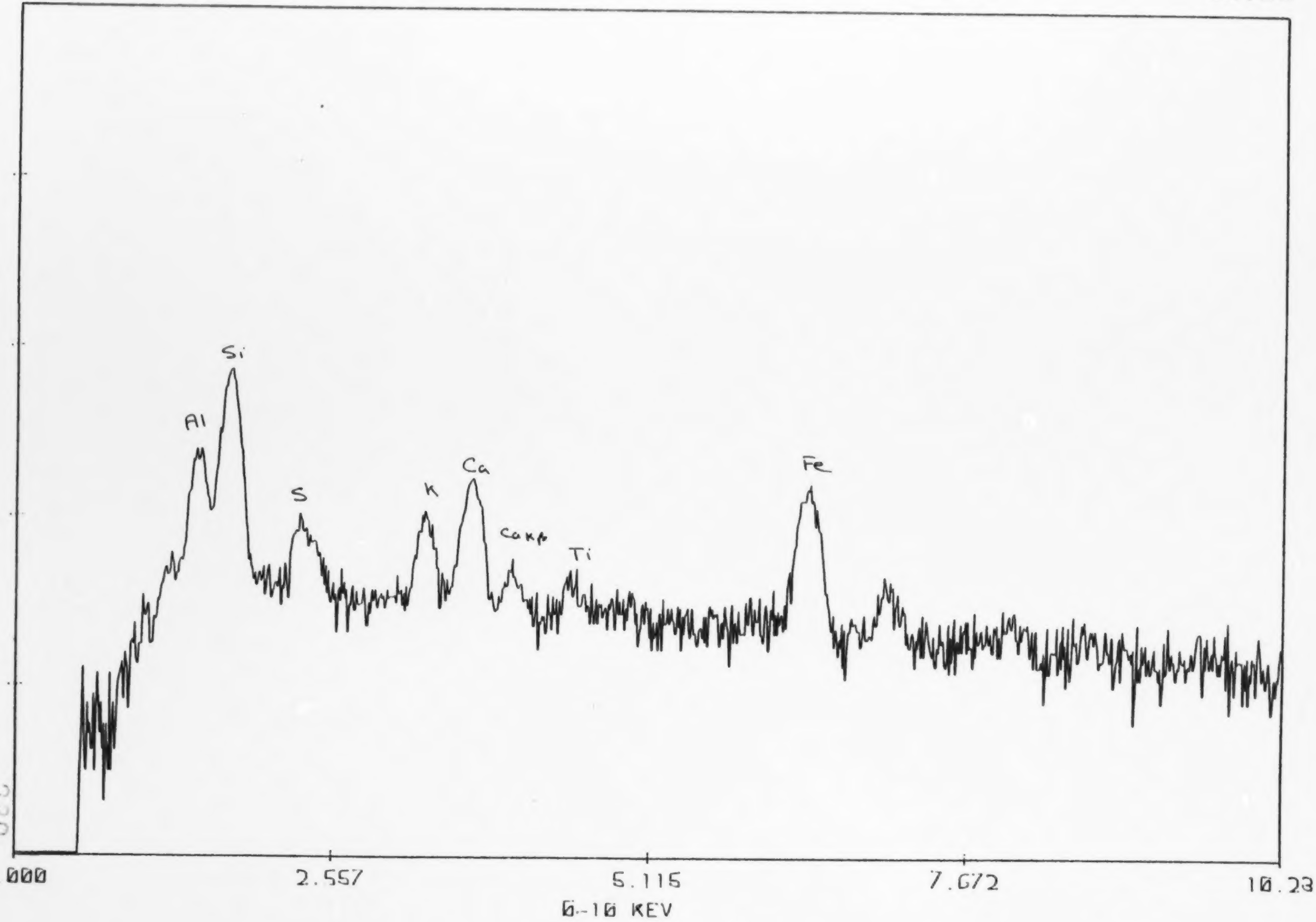


FIG. IV 1

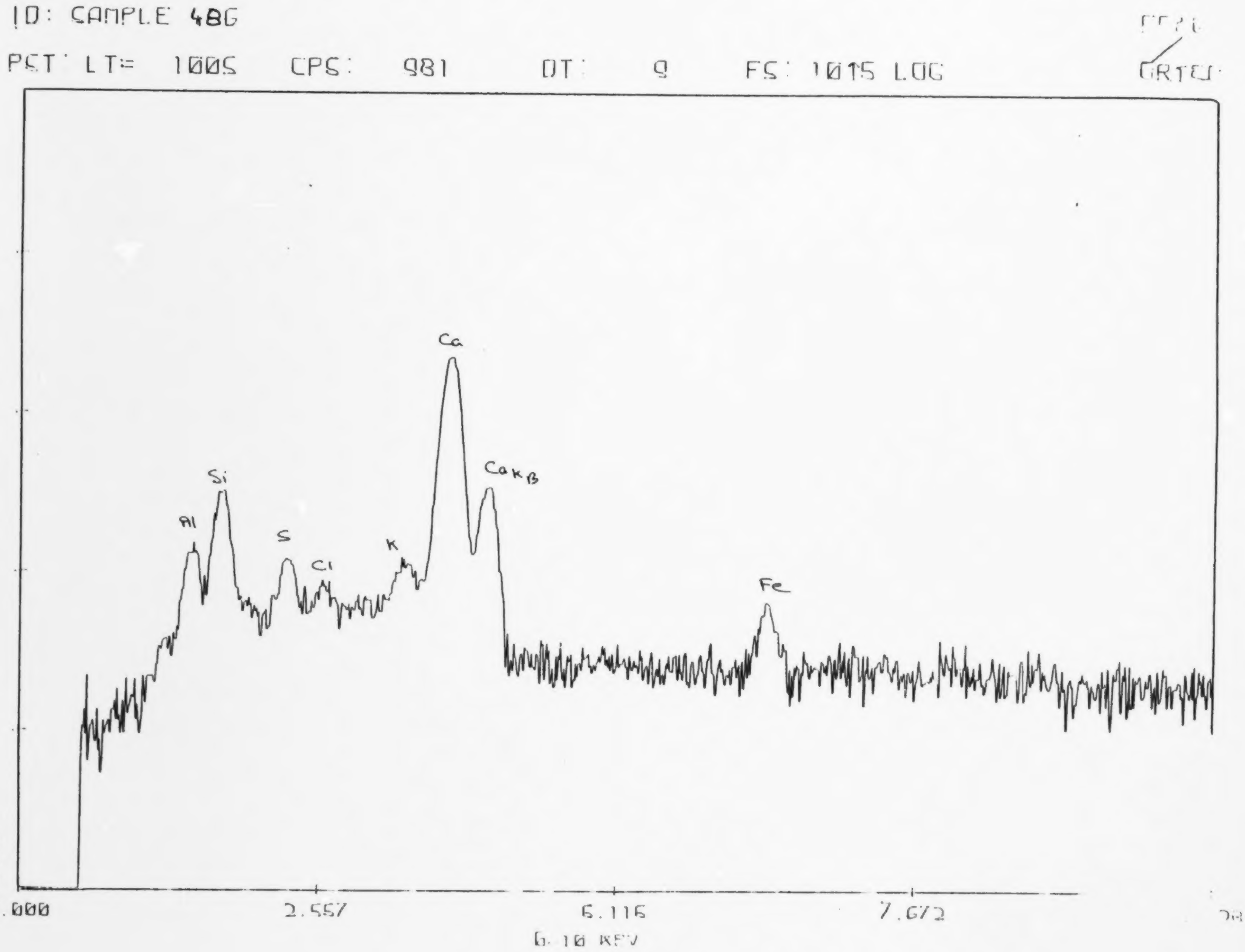

ID: SAMPLE 4BG
PST LT= 100S CPS: 981 DT: 9 FS: 1015 LOG
Al
Si
S
Cl
K
Ca
CaKB
Fe
0.000
2.557
5.116
7.672
0.10 KEV

FIG IV. 2

CHAPTER V

FILTER SLUDGE

HZ-151 (Soil)

High organic concentration in the soil did not allow any scanning electron microscopy to be done on this sample. Under the optical microscope, large angular quartz grains can be observed but may be less common than in the other soil samples; whereas aggregates of small brownish colored grains are more common compared to the other soil samples. The aggregation may be due to the high concentration of the organics in the sample.

The XRD pattern of this sample differs from the one obtained from soil samples from other contaminated areas. The intensities patterns are generally low, with illite peaks stronger than those of quartz, thus indicating the clay mineral makes up most of the soil. This observation agrees with the optical observation of very little quartz in the sample. Some calcite is also present. The XRD pattern has a broad hump in the 15-25 degree two theta range, presumably due to the presence of poorly crystalline material in the sample. Several unidentified peaks are still present.

HZ-621 (Slurry)

Scanning electron microscopy of the sample indicated the common presence of thin, fan-like crystals, about 100 micrometer in length along the long axis. (Photomicrographs could not be taken because of charging.) Angular quartz grains are uncommon under the optical microscope. Brownish colored aggregates are present, but less abundant than in the soil.

The phases identified from the XRD pattern are listed in Table V.1. Several new phases can be found in the sample compared to the soil. Portlandite peaks are very strong; unhydrated calcium silicates (both C_3S and C_2S) can be readily identified; and gypsum and ettringite are conspicuous. The amount of gypsum is higher than found in most core samples. Some C_3A may also be present. Quartz and illite peaks are weak, indicating that they form a minor proportion of the sample. A peak around 8.60 A (8.58 A in this sample) has been observed in almost all the samples. This peak is weak in the soil sample (HZ-151) but strong in this slurry.

HZ-577 and HZ-591 (Cores)

The porous nature of HZ-577 can be easily seen in the SEM (Plate V.1). The larger pores, of variable shape and size, are not necessarily due to trapped air bubbles. Some well crystallized phases can be found in some areas (plate V.2); one is plate-like (middle-left) and the other needle-like (diagonally to the right), presumably ettringite. Similar to the other core samples, these well crystallized phases are found to grow into these pores or cracks.

The phases present in HZ-577 are listed in Table IV.1. The peak intensities in the sample are low compared to the soil and slurry samples. The most intense peak is that of unhydrated C_3S (2.77 A). C_2S (2.18 A) can also be identified. Portlandite peaks are present (e.g., 4.90 and

TABLE V.1

Mineral Phases Identified by X-Ray Analyses
Filter Sludge Area

SAMPLE	TYPE	PHASES PRESENT*
HZ-151	Soil	Illite, quartz and calcite.
HZ-621	Slurry	Portlandite, calcite, gypsum, illite, quartz, ettringite, C_3S, C_2S, and C_3A.
HZ-577	Core	Portlandite, ettringite, calcite, quartz, illite, C_3S and C_2S.
HZ-591	Core	Portlandite, ettringite, calcite, quartz, illite, C_3S and C_2S.

*The phases are not listed according to abundance.

2.62 A) but very subdued. The amount of calcite is not very high, thus it is unlikely that portlandite has been converted to calcite by carbonation. The low concentration of portlandite and a high amount of C_3S together suggest that insufficient water was making contact with cement grains resulting in a low degree of hydration. A peak around 8.62 A is quite prominent.

A SEM photomicrograph of HZ-591, taken at the same magnification (50 X, Plate V.3) as HZ-577, shows that both the samples have more or less similar pores and porosity. Plate-like crystals are common, particularly along cracks (e.g., Plate V.4, left). Quartz grains, which can be easily identified in the SEM by their morphology, are quite uncommon. Optically, the sample shows fewer quartz grains. Brownish colored aggregates are common, and individual grains in the aggregate are more well defined.

Only HZ-591 was analyzed by EDXRA (Fig. V.1). Si, Ca, Al, S and Fe are present in significant concentrations, and K and Ti are present as minor elements. The abundance of Ca suggests that it is coming from the binder and the binder is a CaO based agent.

Table V.1 lists the phases present in the sample, as evidenced from the XRD pattern. There is a similarity between the two core samples but the intensities are slightly higher in this instance. More portlandite and calcite, and less unhydrated C_3S are found in this sample. Ettringite peaks are very common. Some unhydrated C_2S can also be found. Both illite and quartz can be found in the XRD pattern but their low intensities suggest they are minor components in the sample. Similar to all other samples considered in this group, two peaks around 8.63 and 8.73 A can also be found in this sample.

HZ-577

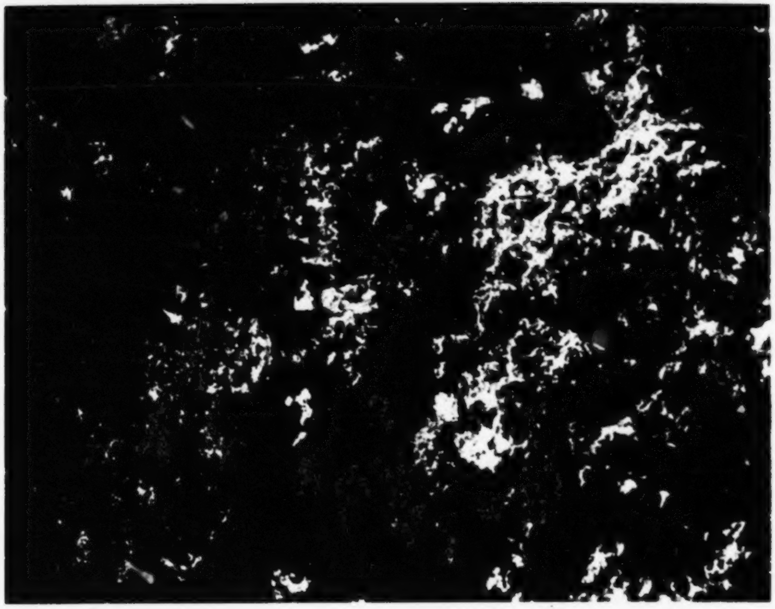


Plate V.1

HZ-577

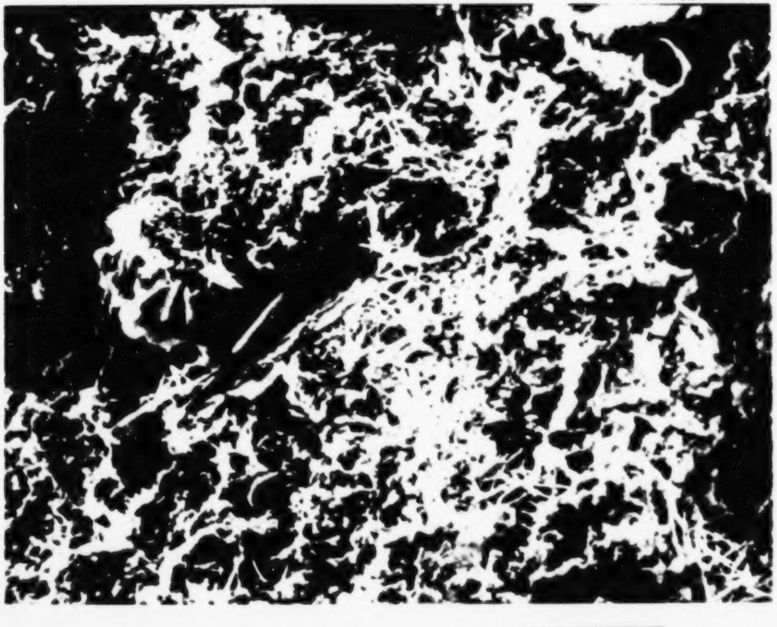


Plate V.2

HZ-591

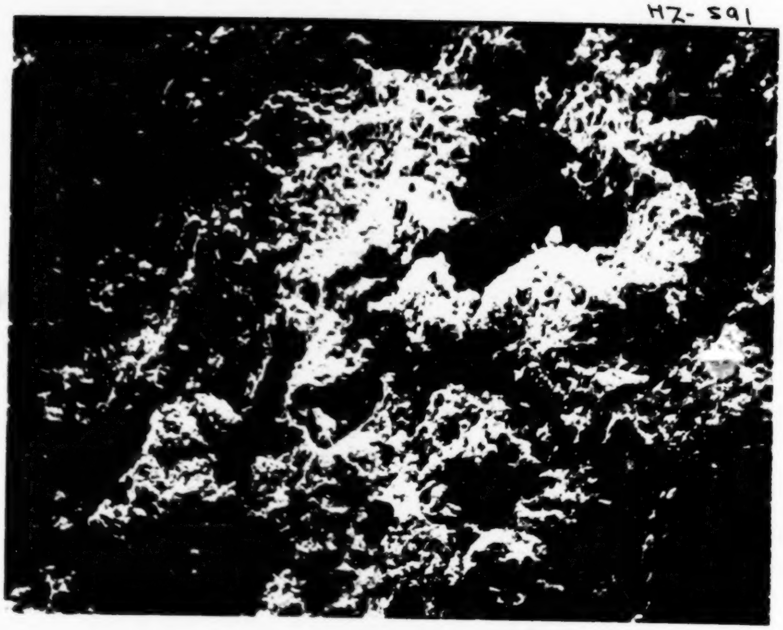


Plate V.3

HZ-591

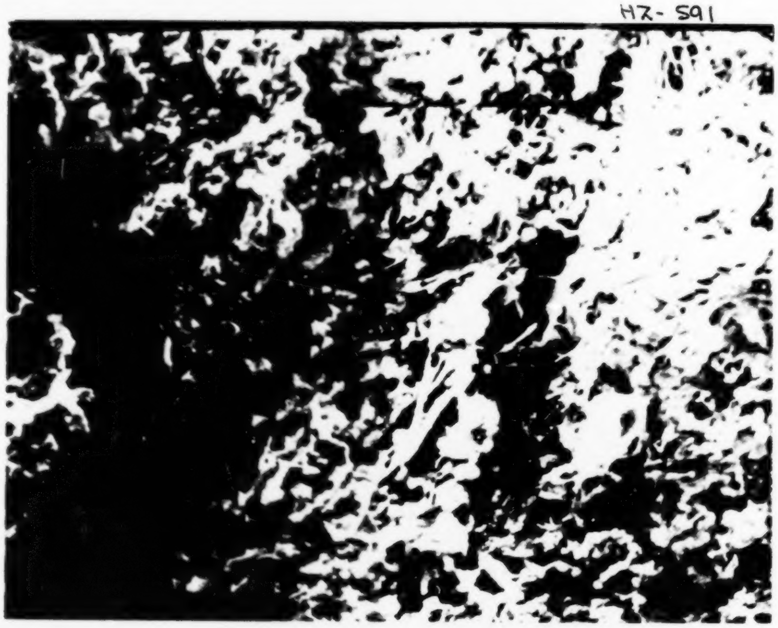
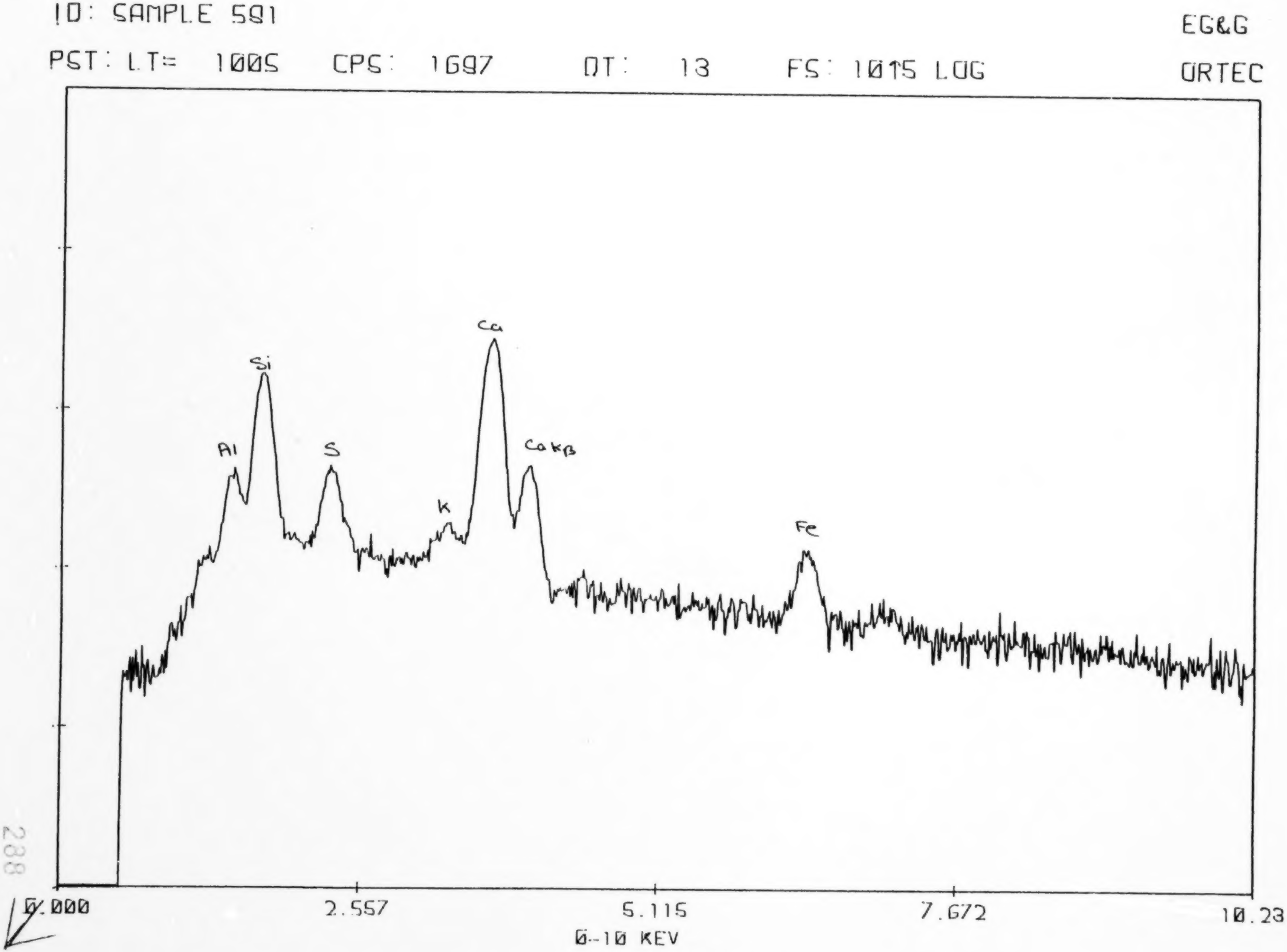


Plate V.4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PST: LT= 100S CPS: 1697 DT: 13 FS: 1015 LOG
EG&G
ORTEC
Al
Si
S
K
Ca
CaKβ
Fe
0.000
2.557
5.115
7.672
10.23
0-10 KEV

FIG. V.1

CHAPTER VI

DRUM STORAGE AREA

RESULTS

HZ-029 (Soil)

Plate VI.1 shows a scanning electron photomicrograph of the soil sample. Abundant angular quartz grains, averaging about 30 to 40 micrometer in length, are present. The clay minerals are present as irregular aggregates in between these quartz grains and act as a loose binding agent. Under the optical microscope, in transmitted light, the quartz grains are again evident. They can be easily identified by their birefringence and shape. Aggregates of small brownish colored transparent particles are also found. The individual particles in these aggregates are much smaller than the quartz grains. Their concentration is much less than the soil samples from other areas.

The phases identified from the XRD pattern of the soil are listed in Table VI.1. Many of the quartz peaks can be identified, suggesting it is abundant - similar to the other soil samples from other areas. Only one type of clay mineral, illite, can be found. Some calcite and magnetite are also present. Several unidentified peaks still remain in the XRD pattern which could not be associated with any clay minerals or quartz. These could be due to the organics.

TABLE VI.1

Mineral Phases Identified in X-Ray Analyses - Drum Storage Area

SAMPLE	TYPE	PHASES PRESENT*
HZ-029	Soil	Quartz, illite, calcite, magnetite.
HZ-520	Core	Quartz, illite, portlandite, ettringite, C_3S.
HZ-538	Core	Quartz, illite, portlandite, ettringite, C_3S.

*The phases are not listed according to abundance.

HZ-520 and HZ-538 (Cores)

Scanning electron microscopy shows that quartz grains are quite common in the solidified sample HZ-520 (Q, 500 X, Plate VI.2). The grains can be easily identified by their angular, broken nature. The grain size of quartz is variable. Thin, plate-like, hexagonal crystals can be seen in some areas (Plates VI.2 and 3). These usually grow into the pores. A higher magnification (2,000 X, Plate VI.4) photomicrograph shows that the binder phase contains thicker, layered material, similar to the C-S-H phase in Portland cement. Optical microscopy shows that angular quartz grains are very common in HZ-520. Brownish colored aggregates, transparent to translucent, can be observed. Some very small opaque grains can also be observed and are quite common.

A low magnification photomicrograph of HZ-538 is shown (50 X, Plate VI.5). The sample is locally dense but abundant pores are present. The pores vary in size and origin. Some of them may be due to trapped air bubbles. A higher magnification photomicrograph of the sample (1000 X, Plate VI.6) shows that some of the porosity is in between cracks rather than being inter-particle. Ettringite needles (E) can be seen growing into these cracks and elsewhere (Plate VI.6). Some dense, tabular material can be seen in the lower middle of the photomicrograph, and is likely to be C-S-H or massive portlandite. HZ-538 is similar to HZ-520, but may contain more quartz than the latter. Brownish colored aggregates are also found but their concentration is lower than in most other cores from other areas and may be even less than in HZ-4=520. Opaque inclusions in a cementitious matrix can be seen in HZ-538.

The XRD patterns of the cores HZ-520 and HZ-538 are very similar to each other. Quartz and illite are common to both the cores; these phases presumably came from the soil. Portlandite, ettringite, and unhydrated C_3S can also be identified in the cores. Some of the unidentified peaks from the soil can be traced to the core samples; particularly, two peaks around the 8.57-8.58 A region, observed in the soil sample, can also be observed in the core samples.

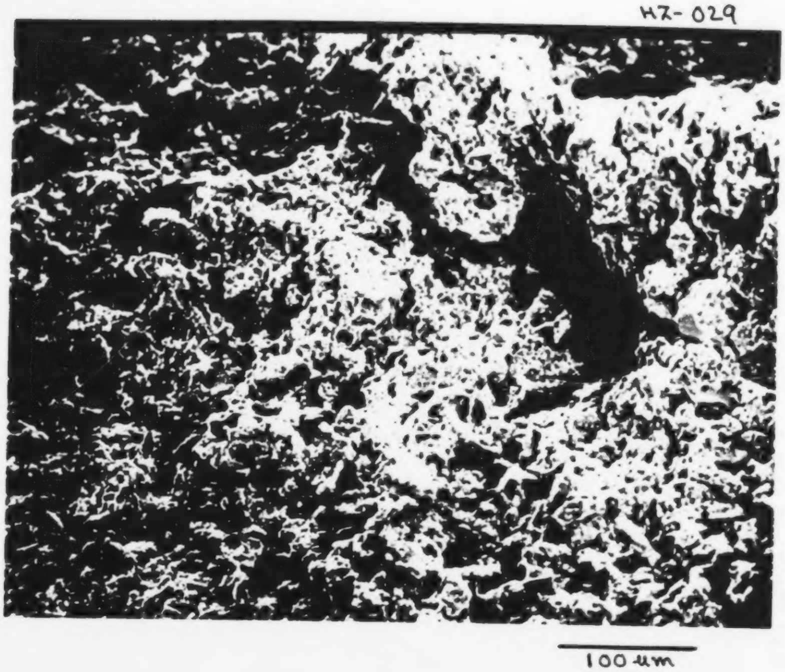

HZ-029
100 um

Plate VI. 1

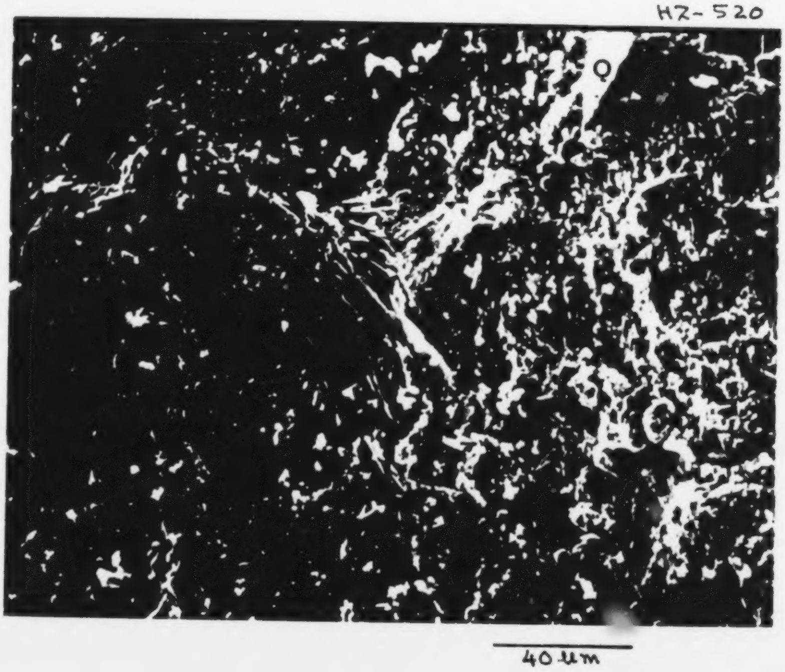

HZ-520
Q
40 um

Plate VI. 2

HZ-520

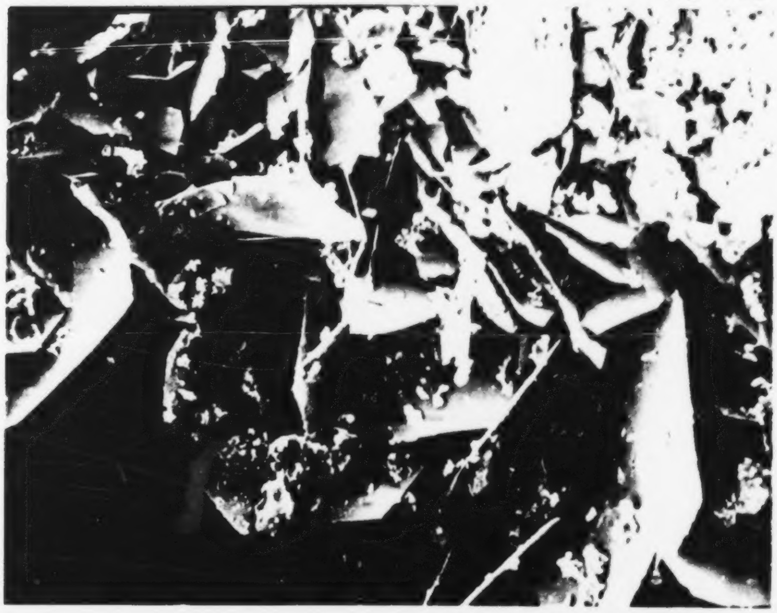


Plate VI. 3

HZ-520

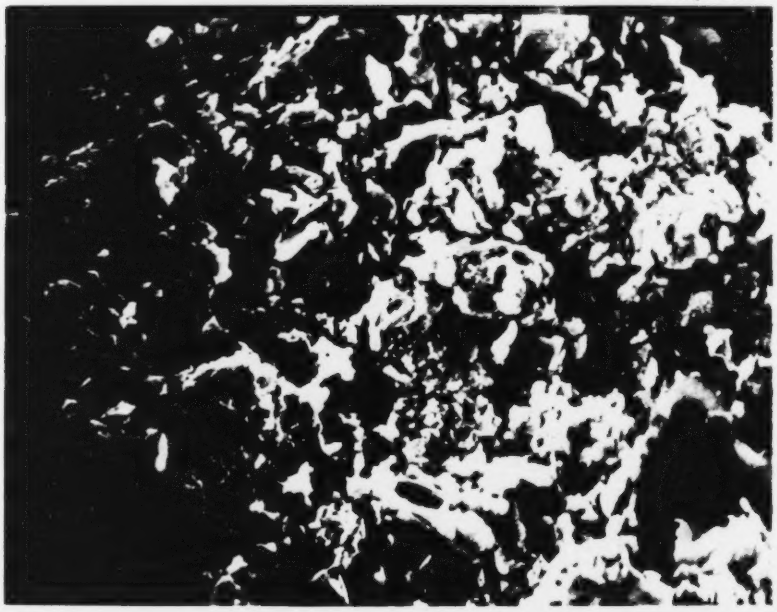
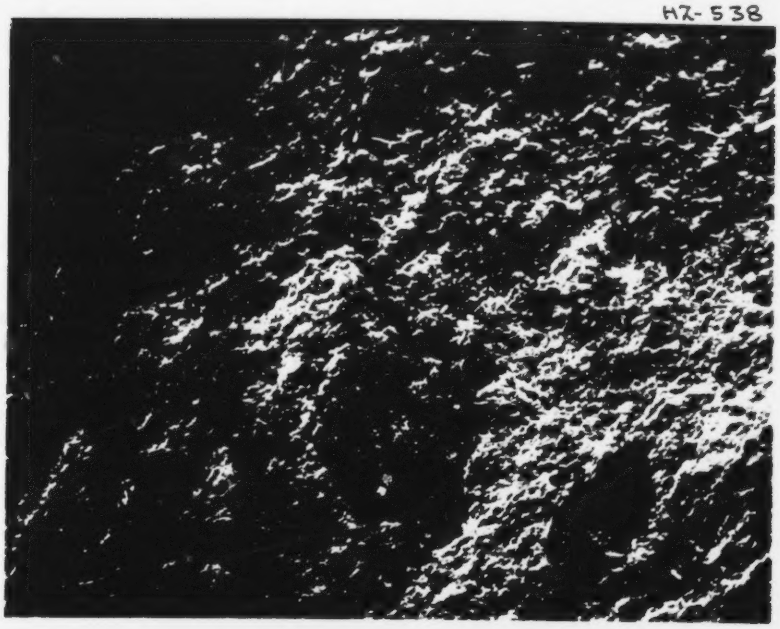


Plate VI. 4

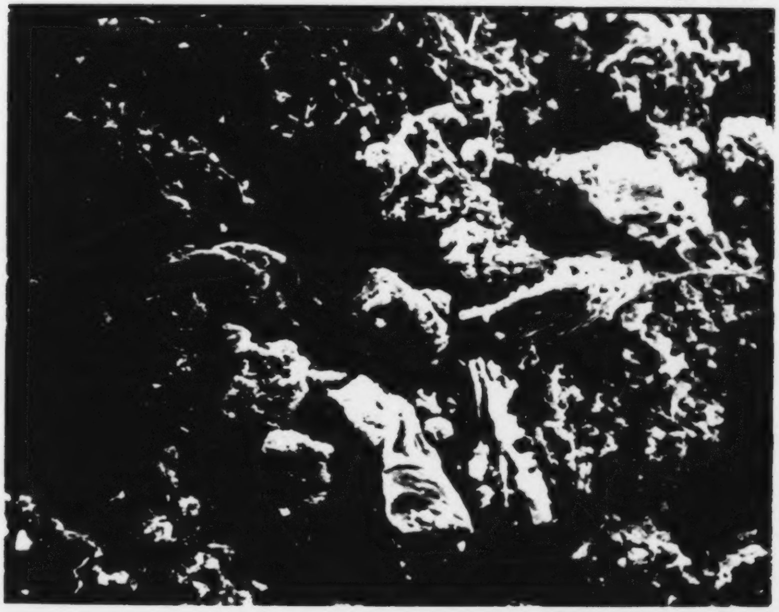
HZ-538



400 um

Plate VI. 5

HZ-538



20 um

Plate VI.6

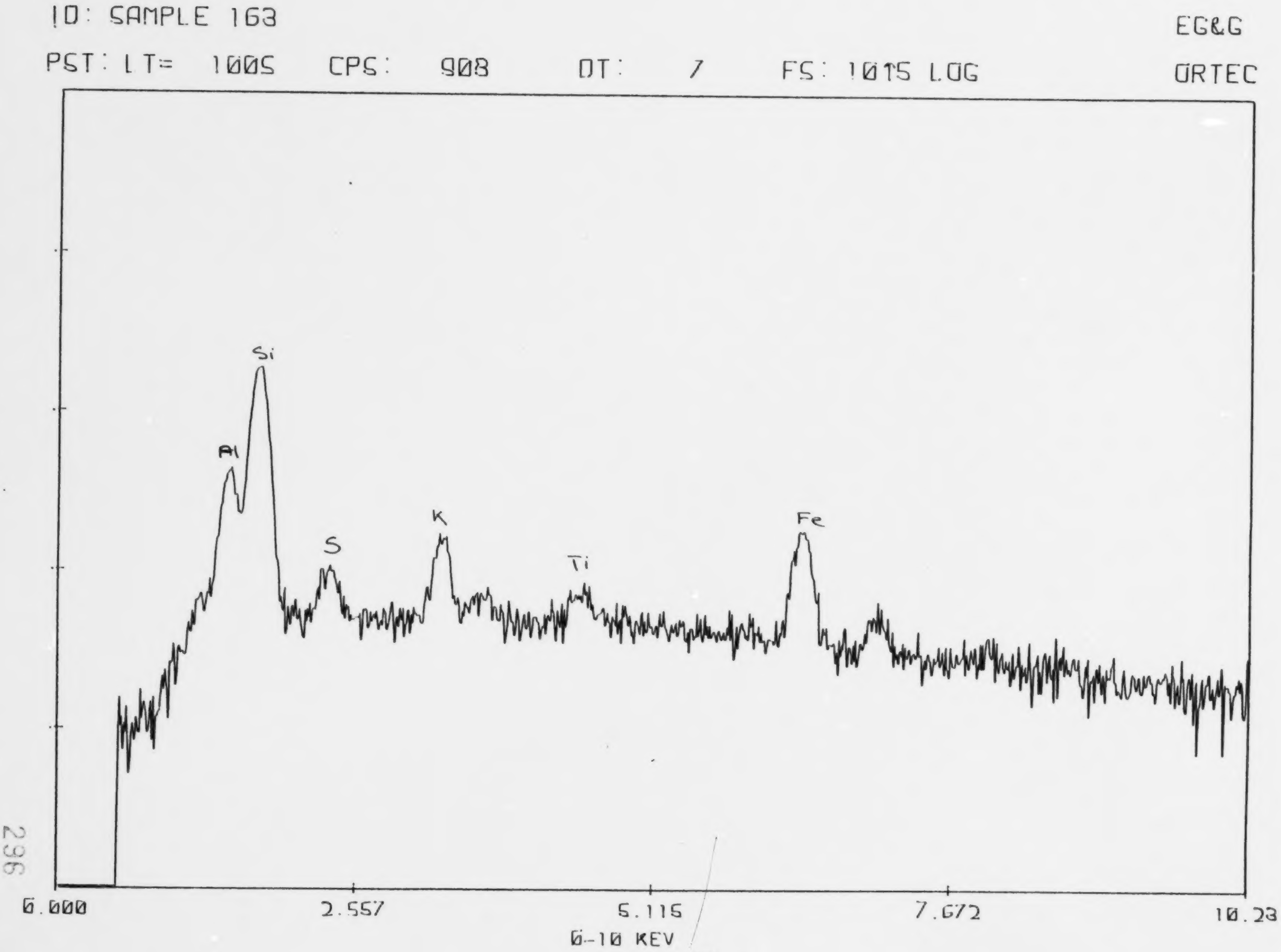

ID: SAMPLE 163
EG&G
PST: LT= 100S
CPS: 908
DT: 7
FS: 10↑5 LOG
ORTEC
Si
Al
S
K
Ti
Fe
0.000
2.557
5.115
7.672
10.23
0-10 KEV

FIG. VII.1

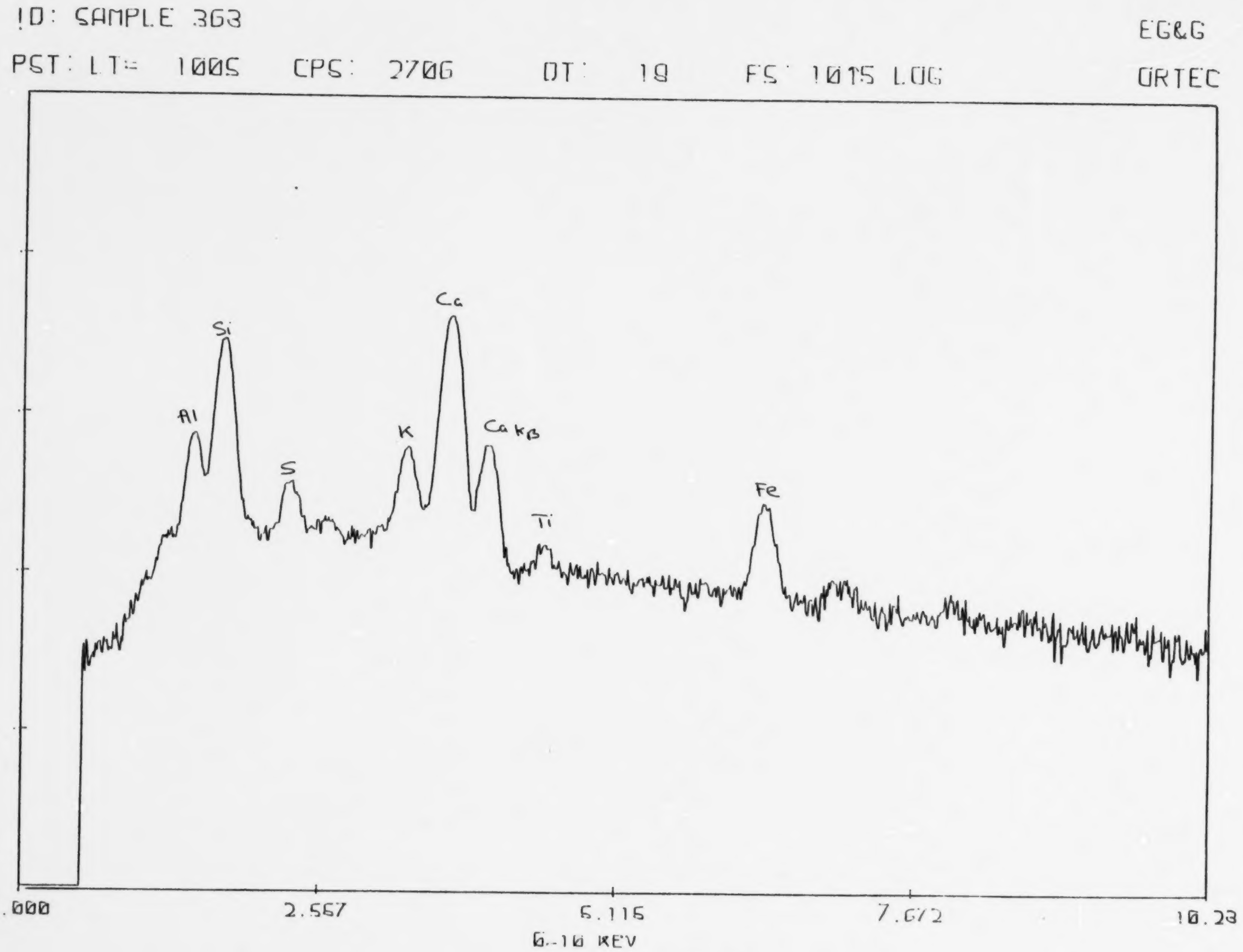

ID: SAMPLE 363
PST: LT= 100S CPS: 2706 DT: 19 FS: 1015 LOG
EG&G
ORTEC
Al
Si
S
K
Ca
Ca Kβ
Ti
Fe
0.000
2.557
5.115
7.672
10.23
0-10 KEV

FIG. VII. 2

CHAPTER VII

LANDFARM AREA

HZ-163 (Soil)

The quartz-rich nature of the soil can be seen in the SEM (Plate VII.1). The quartz grains are often large, about 30 to 40 micrometer in length, and typically have conchoidal fracture. Much finer grained clay minerals can be seen in between these quartz grains. Under the optical microscope, clean, angular quartz grains are quite common. Brownish colored aggregates, composed of smaller transparent grains are present. The brownish color appears to be a coating around these grains.

An EDXRA spectrum of the soil sample is shown in Fig. VII.2. It was collected from a 200 micrometer area. The elements present, in order of decreasing abundance, are Si, Al, Fe, K, S and Ca. The presence of K in the spectrum indicates that the clay mineral is likely to be illitic, which is compatible with the XRD observation. Sulphur is not very common in ordinary soil; it presumably came from the contaminants.

Two phases can be identified in the XRD pattern; quartz and illite (2M type). The illite peaks are weak relative to quartz indicating quartz is volumentrically most important in this soil. Other unidentified peaks still remain, such as one at 8.69 A, which can be observed in most other soil and core samples.

HZ-337 and HZ-363 (Cores)

Scanning electron microscopy shows that the sample has fewer large pores compared to the other core sample. Plate VII.2, taken at 2,000 X, shows an ellipsoid-shaped grain in the center and some radiating needle-like crystals. The grain is probably a calcium silicate grain and the needles are those of ettringite. Smaller pores can be seen in the photomicrograph. The morphology of the binding agent can be seen in plate VII.3. It is locally very dense and morphologically appears like C-s-H. In other areas it is more porous and finer grained. Large angular quartz grains, very similar to those in the soil, can be seen in HZ-337 under the optical microscope. They can be identified by their birefringence and absence of cleavage. Brownish colored aggregates, composed of smaller transparent particles, are also found in the sample. Another type of grains, smaller and opaque in transmitted light can also be seen. They are sometimes present as inclusions in the larger brownish aggregates.

A low magnification SEM photomicrograph (200 X, Plate VII.4) of HZ-363 shows that it contains more pores than HZ-337. Some of these pores may be due to trapped air bubbles. Large, thin hexagonal crystals can be seen growing in one of these pores. This sample also appears to be more heterogeneous than the other core. The dense nature of the C-S-H can be observed in some areas (Plate VII.5). Locally, abundant needle-like ettringite can be seen (Plate VII.6). Optical microscopy does not show significant difference between the two core samples, as with HZ-336, HZ-363 contains brownish aggregates of transparent grains. Quartz, as usual, is common. Opaque grains, smaller than the brownish aggregates, are also found. The persistence of these brownish colored aggregates in the core samples indicates that disaggregation of the soil does not occur during mixing with the solidifying agent.

The EDXRA spectrum of HZ-363 (Fig. VII.2), also taken from a 200 micrometer area, shows that the same elements found in the soil are present, but the relative abundances are very different. Ca, for example, has the highest concentraton, and some Cl and Ti can also be identified. The Ca is presumed to have come from the binding agent. S may have come both from the binding agent and the soil. The chemical composition is typically that of a CaO based binding agent, such as Portland cement.

The XRD patterns of the two cores are more or less similar, but some variations are present. The same group of phases can be identified in both the patterns but the relative abundances are different. More calcite and ettringite can be found in HZ-337, and the 8.58 A peak is more pronounced than in HZ-363. More quartz is probably present in HZ-363. Unhydrated C_3S is found in both.

TABLE VII.1

Mineral Phases Identified in X-Ray Analyses - Land Farm Area

SAMPLE	TYPE	PHASES PRESENT*
HZ-163	Soil	Quartz, illite.
HZ-337	Core	Quartz, portlandite, calcite, illite, ettringite, C_3S.
HZ-363	Core	Quartz, portlandite, illite, calcite, ettringite, C_3S.

*The phases are not listed according to abundance.

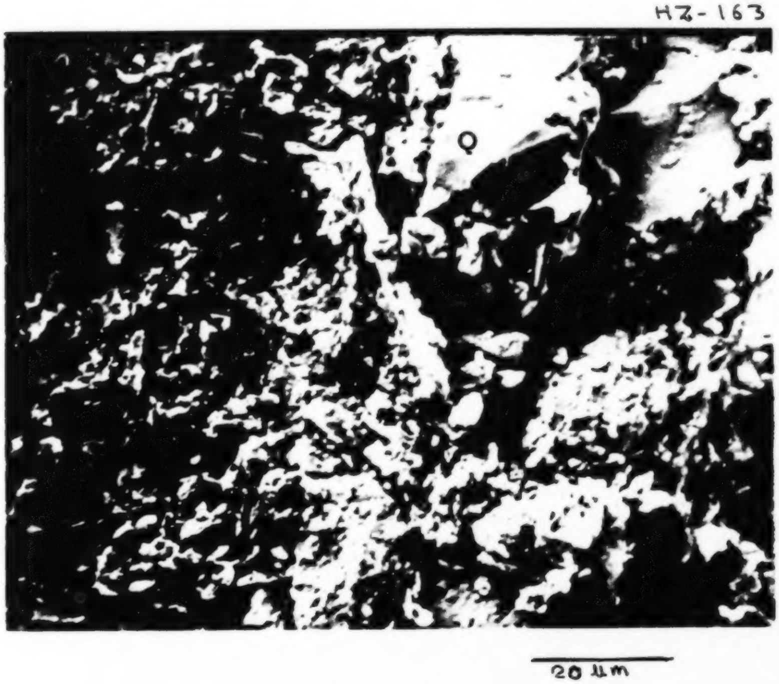

HZ-163
Q
20 µm

Plate VII. 1

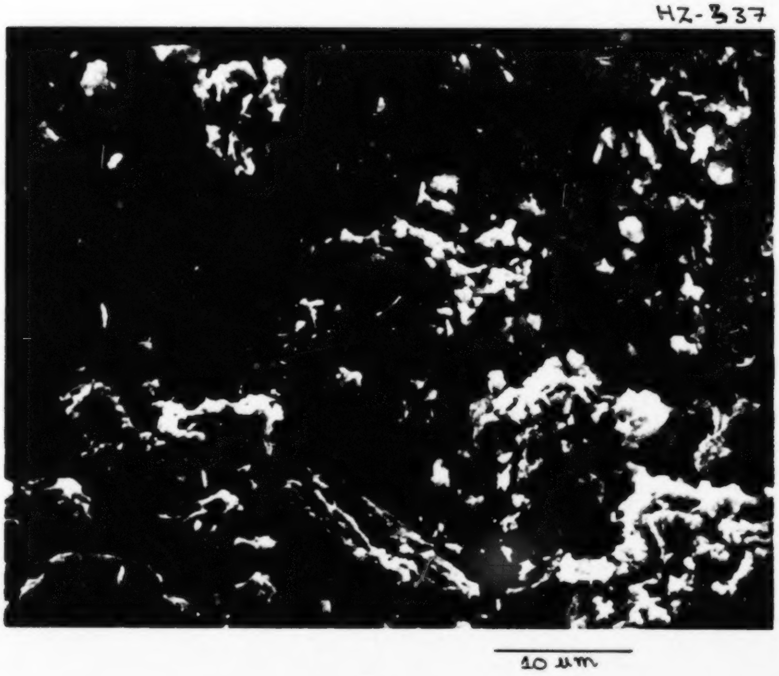


Plate VII. 2

HZ-337

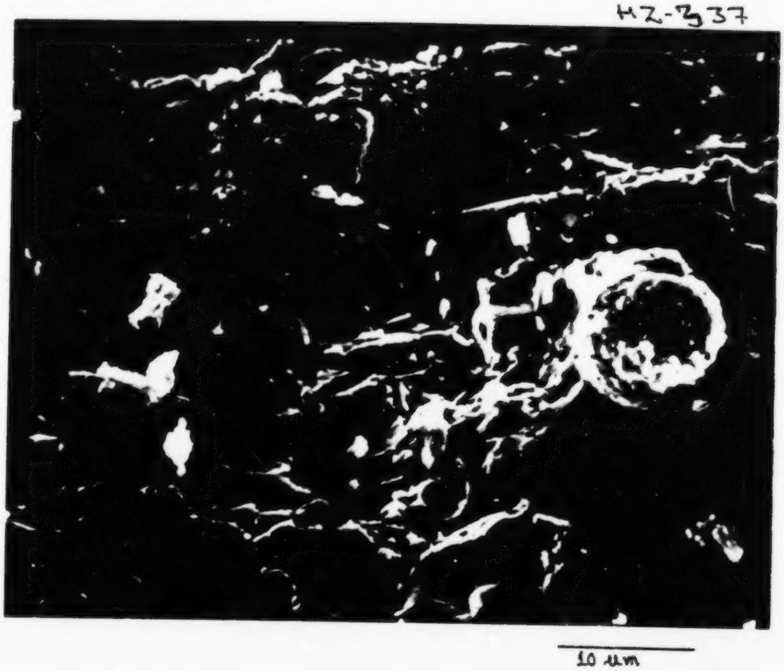


Plate VII.3

HZ-363

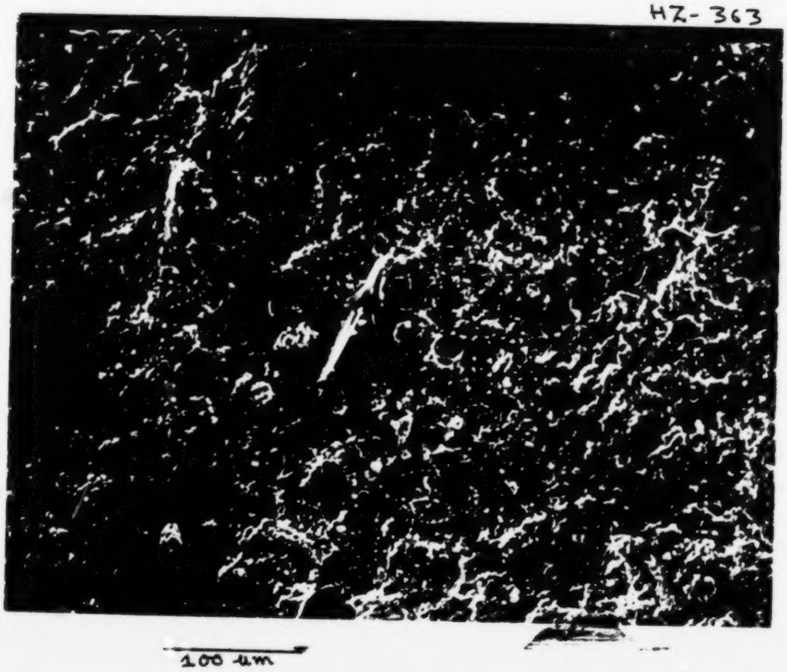


Plate VII.4

HZ-363

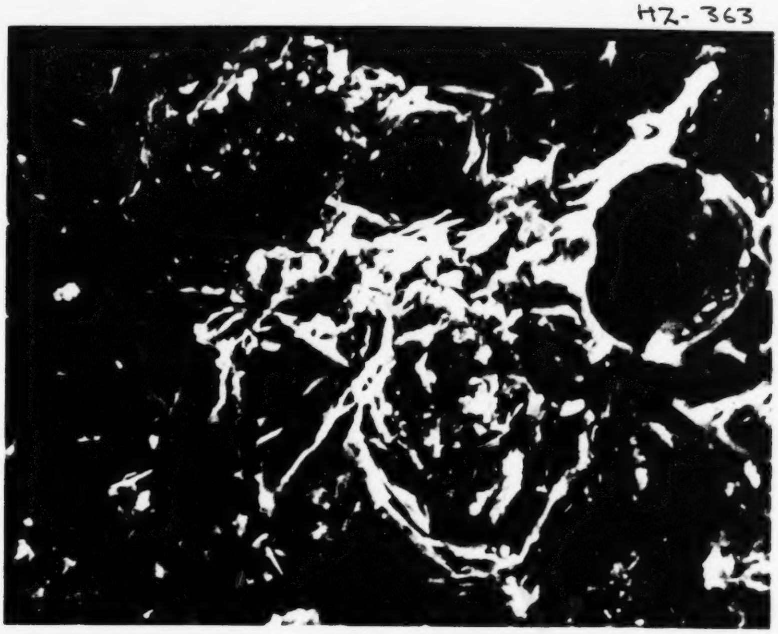


Plate VII. 5

HZ-363

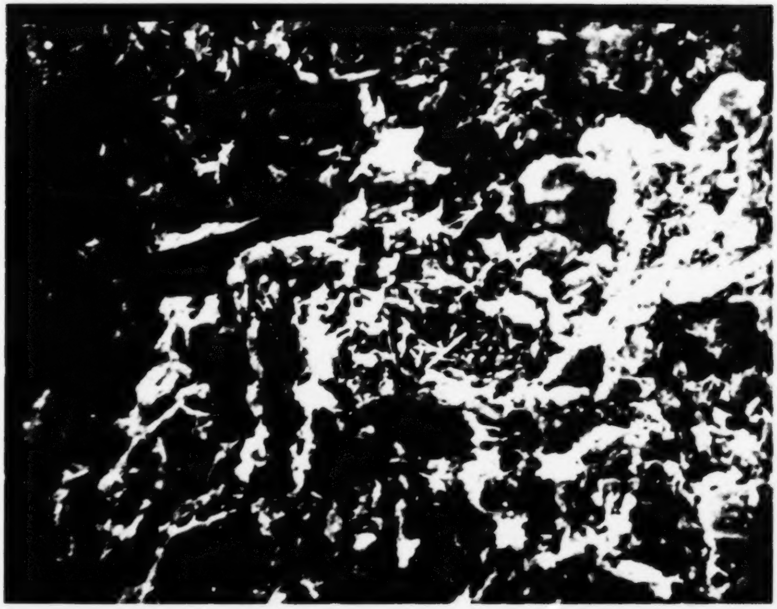
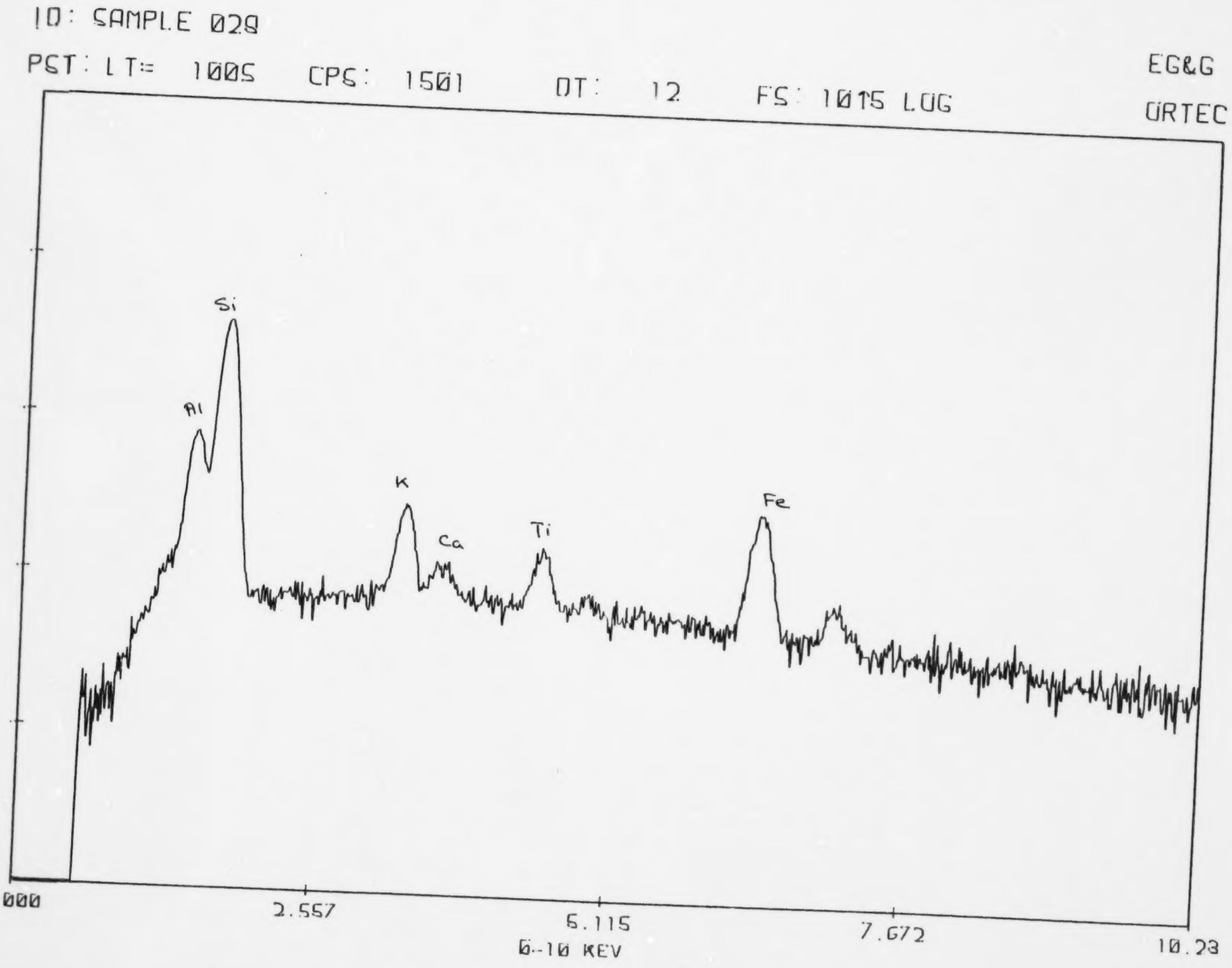


Plate VII. 6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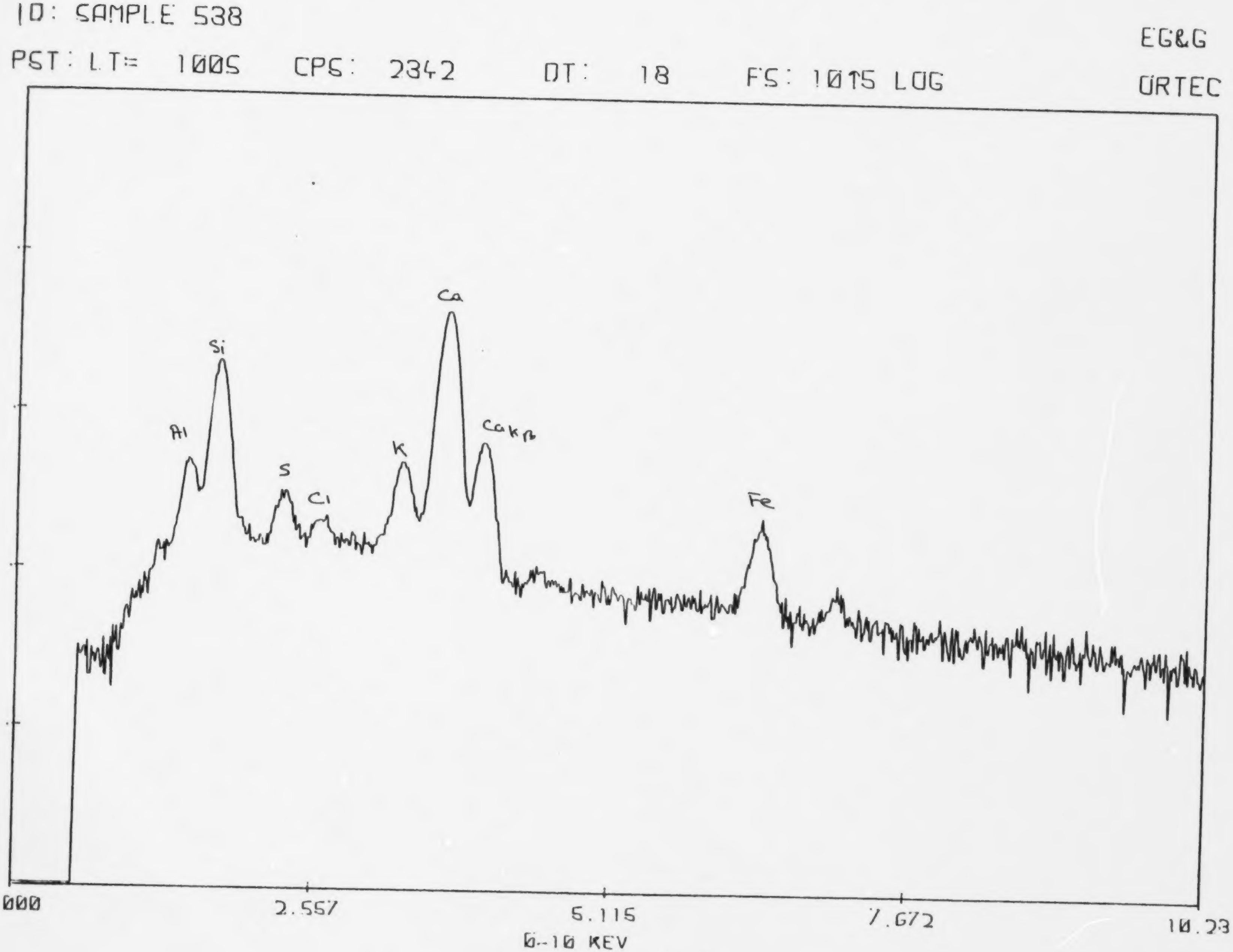
CPS: 1501
DT: 12
FS: 1015 LOG
EG&G
ORTEC
Al
Si
K
Ca
Ti
Fe
0.000
2.557
5.115
7.672
10.23
0-10 KEV

FIG. VI.1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CPS: 2342
DT: 18
FS: 1015 LOG
EG&G
ORTEC
Al
Si
S
Cl
K
Ca
Caκβ
Fe
0.000
2.557
5.115
7.672
10.23
0-10 KEV

FIG. VI.2

CHAPTER VIII

DISCUSSION

The composition of the soil can be inferred from various lines of evidence. XRD evidence shows that the major components of the soils are quartz and clay minerals. The clay mineral is usually illite but kaolinite is sometimes present. Both of these are non-expandable clays. Significantly, any expandable clay like montmorillonite could not be found in any sample. The absence of any such clay minerals indicates that none of the organic compounds present in the soil will be adsorbed within the layers of the clay minerals. Any adsorption of organics will be on the outside of the clay minerals (e.g., for illite) and thus more loosely held. Quartz and illite are present in all the soils but their proportions are variable. In some instances the soil is very clay-rich (such as HZ-075). The optical observations agree with the XRD evidence. Optical microscopy shows the presence of large, angular, tens of micrometer diameter quartz grains. The amount of quartz seen under the microscope correlates very well with the peak intensities of quartz in the XRD patterns. Brownish colored aggregates of smaller transparent grains are common in all the samples. These are likely to be aggregates of clay minerals, coated with iron oxide and/or organics. In some of the soil samples, opaque particles, smaller than the brownish aggregates, were observed. They were also found as inclusions within the brownish colored aggregates. Their shape is unlike those of any minerals. The chemical nature of these opaque particles could not be easily inferred. Scanning electron microscopy, with its large depth of field was very useful for the study of the soils. The quartz-rich nature of the soils is obvious in several instances (such as HZ-029). HZ-029 is mostly composed of broken, angular quartz grains loosely cemented together by clay minerals.

The observations made on the core and slurry samples can be used to characterize the nature of the stabilizing/immobilizing agent. XRD patterns of these samples show the presence of phases like portlandite, ettringite, calcium silicates, calcium aluminate and sometimes gypsum. Tri- and dicalcium silicates, tricalcium aluminates and gypsum are principal components of Portland cement. Similarly, portlandite and ettringite are major hydration phases of Portland cement. Thus it appears that the binding agent is mainly Portland cement. SEM observations agree with this conclusion. The nature of the C-S-H is similar to that found in Portland cement; hexagonal plate-like crystals (portlandite or calcium aluminate hydrates) are typical of Portland cement; and needle-like ettringite crystals are also common. EDXR analysis showed that the main element added to the soils was Ca. CaO could come from other similar CaO-based binding agents but is also suggestive of Portland cement. Fly ash is often used in immobilization/stabilization, at least as a partial replacement of Portland cement. Fly ash was not observed in any of the core samples. Fly ash can be easily recognized in the SEM by its spherical shape and the hollow broken spheres. Such features were lacking in all the core samples. XRD patterns of the cores also did not suggest the presence of phases typical of fly ash, such as mullite. The ubiquitous presence of ettringite in all the samples, and the prominence of the S peak in EDXR analysis suggest some excess gypsum may haave been used in addition to the amount normally present in Portland cement.

In the SEM, abundant pores of various sizes and shapes could be seen in all the core samples. The concentration of these pores is variable from one sample to another. Some of these pores are due to trapped air bubbles, but other types of pores are also present. The pores due to the air bubbles have impermeable walls but sometimes large cracks are present. Thus all these pores can contribute to the total porosity of the sample. The high concentration of the pores in these samples may be due to poor mixing. Crystals of portlandite, calcium aluminate hydrates, ettringite, etc., usually grow into these pores. If the pores are connected, these crystals are thus more easily accessible to percolating water. If the leaching water is acidic, it may lead to localized dissolution of portlandite.

Unhydrated tricalcium silicate (C_3S) was found in all the core samples. In some instances, even dicalcium silicate was observed. Their peak intensities are much higher than usually observed in hydrated Portland cement with moderate water to cement ratio (e.g., w/c = 0.4 to 0.5). Such calcium silicate grains were also observed in the SEM. There are several possible explanations of these results: 1) The amount of water used for mixing may not be sufficient to give a high degree of hydration. 2) Inefficient mixing may prevent sufficient water from being transported to the calcium silicate grains. 3) Some mechanism of inhibition of hydration may be operating as a result of the presence of contaminants.

Several peaks in each XRD pattern often could not be associated with the common phases expected in them. Some of these peaks are present in the soil and can be traced in the slurry and the core samples. The same peaks are present in samples from different areas. Their presence in the cores suggests that the unidentified phases are apparently mechanically held in the binder.

Optical microscopy of the soils revealed the presence of three different types of particles/grains. Quartz, brownish colored aggregates and opaque particles. All these groups were found in the core samples. In the core samples, the quartz grains appeared quite clean and no new material was found adhering to these grains. This is suggestive of a low degree of bonding between the binding agent and the quartz grains. The brownish colored aggregates have more or less remained as such, suggesting poor disaggregation. Scanning electron microscopy shows that there are locally dense areas, while in other areas pores are abundant. This is indicative of the nature of the mixing.

Conclusions:

i. Two factors suggest that soil components survive the solidification/stabilization process unchanged and appear in the cores. They are:
    1) the presences in the cores of apparently unaltered brownish aggregares and;
    2) the observation of XRD peaks which cannot be identified with any expected mineral constituents of the soil, and which are also present in the cores, suggest that contaminant materials are being carried through the solidification process in an unaltered form. Since the two features being referred to are apparently major components of the contaminated soil, it appears that encapsulation is a major part of the mechanism of solidification/stabilization.

iii. Abundant proes are present in the treated core samples, but their concentration is variable from one sample to another.

iv. Mixing does not appear to be highly efficient. Several facts are indicative of this, such as: 1) The brownish aggregates do not undergo disaggregation. 2) There are significant amounts of unhydrated Portland cement clinker in the samples. 3) There are globules of dark colored materials in the treated core samples which are visible to the naked eye. 4) There are many pores, including air bubbles.

v. The binding agent is Portland cement, probably with excess gypsum.

vi. An unusually high amount of C_3S is present in all the core samples.

APPENDIX D

DATA REDUCTION CALCULATIONS

DATA REDUCTION

To comply with the Quality Assurance Project Plan (QAPP), calculations showing the increase in soil volume, reduction in soil permeability, and change in migration potential for the various organic analytes and lead were performed. The equations for the analyses are shown below with the results summarized in Tables D-1, D-2, and D-3.

Volume Increase

$V_i = V_m - V_s = (1/d_m \times F) - 1/d_s$

$V_c = (V_i/V_s)\ 100$

where:
V_i = volume increase
V_m = volume of treated soil per unit weight
V_s = volume of untreated soil per unit weight
V_c = volume change, %
d_m = density of mix
d_s = density of the untreated soil
F = weight fraction soil in the mix

Permeability Reduction

$PR = (K_u - K_t)/K_u\ (100)$

where:
PR = permeability reduction, %
K_u = permeability coefficient for untreated soils
K_t = permeability coefficient for treated soils

Migration Potential

The potential for contaminants to leach from the soil is stated as a migration potential using the following formula:

$F = (L)(G)(1000)/(S)(W)$

where:
F = fraction leached, ug leached/ug in solid
L = concentration of analyte in leachate, mg/liter
G = volume of leachate, liters
S = concentration of analyte in soil, ug/g
W = weight of solid phase

For the TCLP leach test G = 2 liters and W = 100 g.

The reduction in the migration potential can then be calculated as follows:

$M = [1-(T/U)](100)$

where:
M = reduction in migration potential, %
T = fraction leached from treated soil
U = fraction leached from untreated soil

313

TABLE D-1. VOLUME INCREASE OF TREATED SOILS

Plant Location	Wt. Fraction Soil in Mix	Volume Untreated Soil, ml/g	Volume Increase ml/g	Volume Change, %
DSA	0.40	0.813	0.443	54.5
LAN	0.40	0.714	0.858	120.2
FSA	0.38	0.625	1.117	178.7
LFA	0.41	0.595	0.716	120.3
PFA	0.40	0.578	0.660	114.2
LAS	0.37	0.629	0.924	146.9

TABLE D-2. PERMEABILITY REDUCTION

Plant Area	Permeability, cm/sec Untreated Soil	 Treated Soil	Permeability Reduction, %
DSA	0.57	2.5×10^{-9}	99.99998
LAN	0.0018	2.6×10^{-9}	99.99986
FSA	---	$84. \times 10^{-9}$	--
LFA	0.02	4.5×10^{-9}	99.99998
PFA	0.077	1.2×10^{-9}	99.99998
LAS	0.000015	1.0×10^{-9}	99.98467

TABLE D-3. MIGRATION POTENTIAL$^{(1,4)}$

$\frac{\text{ug leached}}{\text{ug in soil}}$

Plant Area	VOC Untreated	VOC Treated	Toluene Untreated	Toluene Treated	BNAs Untreated	BNAs Treated	Phenols Untreated	Phenols Treated	Metals - Pb Untreated	Metals - Pb Treated	Migration Reduction of Lead, %
DSA	13.55	5.70	3.55	5.97	--	ND(2)	ND	ND	0.0093	0.000169	98.19
LAN	0.166	0.285	0.200	0.625	0.938	0.617	3.73	0.81	0.0691	0.000036	99.95
FSA	0.137	0.148	0.192	0.274	0.108	0.151	0.139	0.429	0.0159	0.00080	95.03
LFA	8.35	0.300	8.35	0.312	0.0625	ND	ND	(3)	0.0404	0.000540	98.67
PFA	4.78	0.730	4.78	0.757	0.0519	0.533	ND	(3)	0.0567	0.000061	99.89
LAS	0.154	0.305	0.667	0.562	0.0059	0.306	ND	1.93	0.0706	0.000313	99.56

(1) Based upon TCLP leaching test.
(2) ND - Not detected
(3) Below quantification limits
(4) Values for organics are both increases and reductions. Also some values of migration potential are greater than 1.0, which indicates more analyte were leached than existed in the soil, which is impossible. Therefore, migration reductions for organics were not calculated.